



Development of Teacher Training Model in Applying Numeracy Across The Curriculum Approach

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ABSTRACT

This research focuses on the study of teacher training models in applying numeracy across the curriculum approach. The research approach that will be used in this research is Research and Development, with the Training and Development Cycle Model developed by Dugan Laird. The results of this study are in the form of topics or program structure regarding the creative teacher training model in applying numeracy across the curriculum approach.

Keywords : *teacher training, numeracy learning, across the curriculum*

INTRODUCTION

During the Covid-19 pandemic, with all the limitations of online and face-to-face teaching and learning processes, and the possibility that all subjects cannot be delivered in full, one alternative solution is to focus on learning numeracy. Another focus is on learning reading literacy (language). There are other advantages of learning activities that are centered on numeracy, namely making the responsibility for strengthening the numeracy competence of students not only the commitment of the mathematics teacher, but the responsibility of all subject teachers.

Furthermore, based on the results of the Program for International Student Assessment (PISA) Test, which is an international assessment method as an instrument to measure the competence of Indonesian students at the global level, Indonesian students are placed at a number that requires serious attention. In the aspect of mathematical/numerical literacy skills, during 2000-2018, the achievements of PISA Indonesia for mathematical or numeracy literacy are as follows:

Tabel 1: Indonesian Mathematical Literacy PISA Achievements
(OECD, 2000-2018)

Year	Rank	Number of Countries surveyed	Score of Mathematical Literacy
2000	39	41	367
2003	38	40	360
2006	50	57	391
2009	57	65	371
2012	64	65	375
2015	64	72	403
2018	74	79	396

In Indonesian context, the importance of learning numeracy is stated in Government Regulation (PP) No. 57 of 2021 concerning National Education Standards (SNP), in article 6 paragraph (1) it is specifically stated that the Graduate Competency Standards (SKL) in basic education level education units are focused on inculcating character in accordance with Pancasila values as well as literacy and numeracy competencies.

LITERATURE REVIEW

The term numeration appears recently, based on Goos, et al (2020), the word numeration was first introduced in the UK in 1959 in a Crowther Report (UK Ministry of Education). The document states that the notion of numeracy is a mirror or equivalent to the word literacy, but involves quantitative thinking. Still according to Goos, et al (2020), another early definition of numeracy appeared in 1982, in the Cockcroft Report, which stated that 'being a numerate' means getting used to numbers and the ability to use mathematical skills to solve problems in everyday life. A simple definition of numeracy is stated by Macmillan (in Sellars, 2018), he states that numeracy is a social and cultural perspective to discover and think about mathematical knowledge and its application to solve everyday problems.

In Indonesia, based on the Ministry of Education and Culture (2017), the definition of numeracy is the knowledge and skills to (a) use various numbers and symbols related to basic mathematics to solve practical problems in various contexts of everyday life and (b) analyze information presented in various forms (graphs, tables, charts, etc.) and then use the interpretation of the results of the analysis to predict and make decisions. In other words, numeracy skills are the skills to apply mathematical rules in the context of everyday life.

Numeracy should be studied in a variety of contexts and through all school subjects to be useful to students, not just mathematics. The approach offered is what is known as numeracy across the curriculum, namely the active role of other subject teachers to identify numeracy opportunities in the subjects they teach, as well as to stimulate discussion about numeracy in all subject matter. This does not mean that teachers of other subjects change their function to be mathematics teachers, but that they incorporate numeracy into the subjects they teach, without losing focus on those subjects.

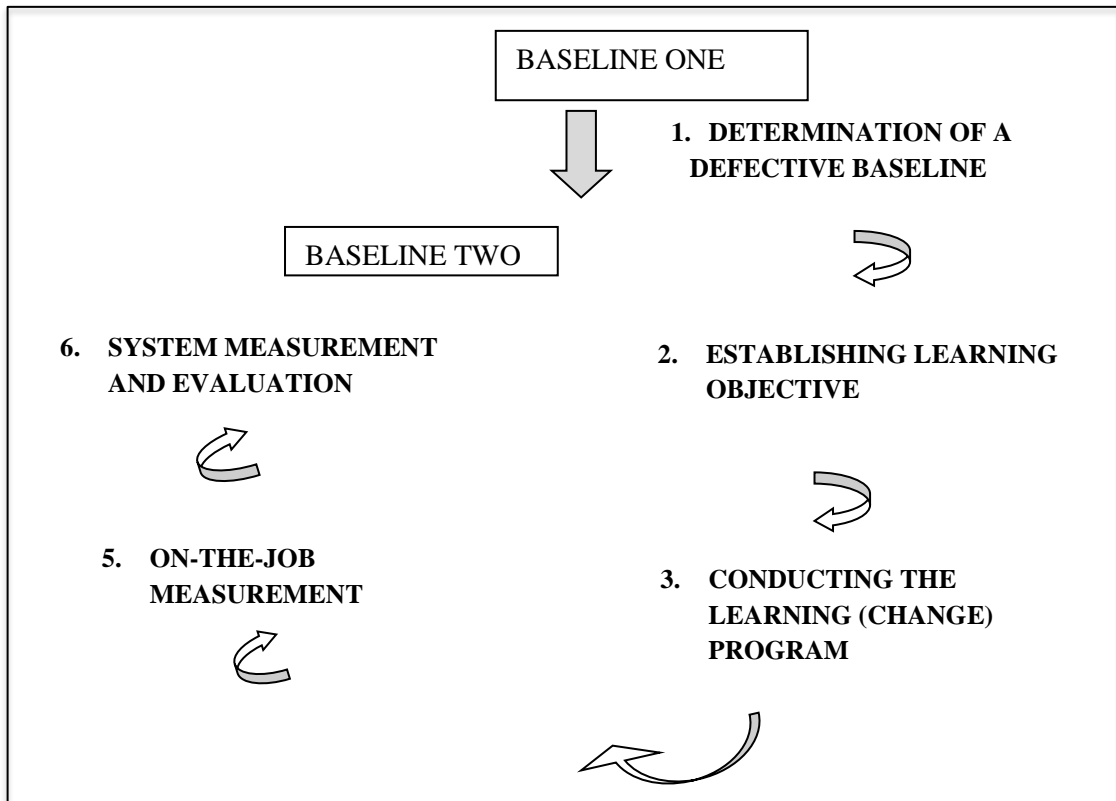
There are two strategies that can be applied to perform numeracy across the curriculum, namely (1) combining mathematics with other subjects; (2) identify material in other subjects that require numeracy skills (Goos, Geiger & Bennison, 2015). In this study, the second strategy was applied, that is identify material in other subjects that require numeracy skills.

The teacher is the most dominant factor in improving students' numeracy skills. Many researchers have studied the importance of the teacher variable in an effort to improve the quality of education, including Barber and Mourshed (2007), who state that the quality of an education system will not exceed the quality of its teachers. Therefore, the focus of this research study is strengthening students' numeracy skills through teacher training in applying numeracy across the curriculum approach.

This study aims to develop a teacher training model in applying numeracy across the curriculum approach to strengthen students' numeracy skills. The output of this research is a training program for teachers in applying numeracy across the curriculum approach to strengthen students' numeracy skills. The results of this study are expected to be input for the formulation of strategic policies in improving students' numeracy skills, especially related to teacher training policies.

METHODS

The research approach that will be used in this research is Research and Development, a process used to develop and validate educational products. The steps of this process are usually referred to as the R&D cycle, with the model used in this research is the Training and Development Cycle Model developed by Dugan Laird, as shown in Figure 1 below.



Picture 1: Training and Development Cycle (Laird,1985)

from the basis of the training and development cycle model, two training cycles are formulated, each cycle consisting of:

1. in service training – 1 (face to face with health protocol)
2. on the job training (learning practice in class)
3. in service training – 2 (face to face offline with health protocols)

Variables and Indicators

The variables of this research are teacher training and teacher creativity in applying a numeracy across the curriculum approach to develop students' numeracy skills. The indicator of teacher creativity in this study is that teachers are able to produce original ideas and works, original actions, and have flexibility of thinking (Kemdikbud, 2020).

Population and Sample

The population of this study were elementary school teachers in West Java, with a sample of 10 elementary school teachers in Purwakarta Regency and 9 elementary school teachers in Cirebon Regency. This sample

was obtained randomly by spreading the registration link through social media assistance.

Data collection technique

Data collection techniques used were interviews, study of learning device documents, and observations of teaching practices carried out by teachers through video recordings.

The following are the interview instruments used:

Table 2: Interview instruments

No	Indicators	Question
1.	Original ideas and works	Could you tell me how you build ideas in preparing teaching materials until the work in the form of teaching materials is realized?
2.	Original ideas and works	Could you tell me how you developed ideas in preparing Student Worksheets (LKPD) until the work in the form of LKPD was realized?
3.	Original action	Could you tell me about one obstacle during the numeracy learning activity that has been carried out, then what action did you take as a solution to the problem?
4	Having flexibility of thinking	Could you please tell me one problem during preparation (could be during the preparation of lesson plan /teaching materials/student worksheet/test questions). Explain several alternative solutions to the problem, then give reasons why you chose one solution.

Data Processing and Analysis Techniques

Data processing techniques were carried out using qualitative methods, data analysis was carried out by formulating and finding appropriate training patterns and teacher creativity based on the results of interviews, document studies, and observations of teacher learning practices.

RESULTS AND DISCUSSION

Cycle 1 Teacher Training

Cycle 1 was carried out in Purwakarta Regency by involving 10 elementary school teachers. In cycle 1, the teacher attended training with the following materials:

Table 3: In-Service Training Program Structure-1

NO	COURSE SUBJECT	HOURS
1.	Introduction to Numeric Learning	5
2.	Best Practices of Numeric Integration in the Other Subjects	10
3.	Identification and Analysis of Basic Competencies	8
4	Preparation of lesson plans, teaching materials, and student worksheets	10
TOTAL		32

At the initial stage of the in-service training-1 training, teachers were given material about the introduction to numeracy learning. After that, the teacher was given examples of good practice of integrating numeracy in other subjects besides mathematics. Furthermore, discussion activities were continued by identifying the Basic Competencies (Strand) of each subject. Identify any strand that contains numeracy elements.

An example of strand analysis is as follows: in the social studies subject for grade 4, there is a strand as follows: "presenting the results of identification of spatial characteristics and utilization of natural resources for the welfare of the community from the city/district level to the provincial level". The presentation of data from the identification of the use of natural resources can be displayed in the form of graphs or diagrams as the application of numeracy learning.

Another example, in the subject of Physical Education, Sports, and Health grade 4, there is a strand as follows: "understanding variations in basic movements of walking, running, jumping, and throwing through modified games/sports and or traditional sports". Numerical learning can be inserted when calculating the score of traditional games or sports carried out by students.

After completing the identification of strand which contains elements of numeracy learning, the next step is to develop the learning objectives to be achieved. In the example above, for the grad 4 Cultural Arts and Crafts subject, the learning objectives for example are students being able to measure three-dimensional shapes with appropriate measuring instruments.

The final stage, of course, is to prepare a Lesson Plan along with teaching materials and assessment instruments that will be used.

After completing the training, teachers are given the opportunity to implement the results of the 2-week training in their schools, with the following program structure:

Table 4: On the Job Training Program Structure

No	Course Subject	Hours
1	Practice Learning in the Class	20
Total		20

After the teachers have finished implementing numeracy learning in their respective classes, the teachers are called back to take part in face-to-face offline training in service training-2 with the following program structure:

Table 5: In-Service Training Program Structure-2

No	Course Subject	Hours
1.	Presentation of the report on the results of learning practices by the teacher	20
2.	Reflection and Training Follow-up Plan	2
Total		22

Cycle 2 Teacher Training

Cycle 2 was carried out in Cirebon Regency by involving 9 elementary school teachers. Based on the results of the evaluation of cycle 1, there was a change in the material in the structure of the cycle 2 program, namely the existence of student interviews, which focused on aspects of student wellbeing.

No	Course Subject	Hours
1.	Practice Learning in Class	20
2.	Student Interview	10
Total		30

Teacher Creativity

From the results of interviews with teachers in in-service training-2, original ideas and works were obtained from teachers in developing cross-subject numeracy learning materials, for example as follows:

1. Integration of numeracy content in the subjects of Cultural Arts and Crafts (Grade 4, Strand: 3.1. understand advertising)

MEMBUAT EMBALASE SEDERHANA BERBENTUK BALOK

Petunjuk:

1. Setiap anggota kelompok membuat satu buah embalase
2. Siapkan alat dan bahan :
 - Kertas karton - Gunting - Lem
 - Pensil - Pensil Warna - Penggaris - Spidol
3. Buatlah jaring-jaring kemasannya, sesuai dengan ukuran yang kalian inginkan.
4. Sebelum dibentuk menjadi kemasannya, buatlah gambar tulisan dan informasi produk pada jaring-jaring yang sudah kalian buat.
5. Jangan lupa memberi warna yang menarik menggunakan pensil warna atau spidol.
6. Jika telah selesai, bentuk kemasan sesuai dengan pola jaring-jaringnya. Gunakan lem untuk merekatkan.
7. Kemasan produk telah selesai dibuat.

Setelah kalian membuat kemasan produk, tersebut. Coba hitunglah isi (volume) yang mungkin kalian isi di dalamnya! (gunakan data: $p \times l \times t$)

Setelah itu coba lengkapi tabel berikut ini dengan menuliskan hasil pekerjaan masing-masing anggota kelompok!

NAMA	UKURAN			VOLUME
	Panjang (p)	Lebar (l)	Tinggi (t)	

Berdasarkan tabel tersebut urutkan isi (volume) kemasan produk, dari yang terkecil sampai yang terbesar adalah _____

Hitunglah rata-rata isi (volume) kemasan produk, berdasarkan data yang telah kalian dapatkan! (rata-rata = jumlah seluruh data : Banyaknya data)

SELAMAT MENERJAKAN

Figure 2. Student worksheet made by one of the teachers

In the picture above, the teacher integrates numeracy content (using measurements) on the material for making product packaging. This material is very interesting, because it turns out that the packaging of daily food or beverage products can be a medium for learning numeracy.

2. Integration of numeracy content in the subjects of Cultural Arts and Crafts
(Grade 4, Strand: 3.3 Understanding regional dance performances)

1. Perhatikan gambar berikut!

a) Gambar nomor 1 termasuk pola dan gambar nomor 3 termasuk pola

b) Gambar nomor 2 termasuk jenis pola garis dan dinamakan pola

2. Dita, Iim, Laela, dan Ocha mendapatkan tugas sekolah yaitu membuat tari kreasi daerah setempat. Mereka memutuskan untuk menari tari kreasi Manuk Dadali yang berasal dari Provinsi Jawa Barat. Terdapat 3 perpindahan posisi penari, gerakan pertama mereka membentuk pola horizontal. Kemudian pada gerakan kedua pola lantai yang mereka bentuk adalah pola lengkung ke depan. Dan gerakan ketiga mereka berganti posisi membentuk pola diagonal. Buatlah 3 gambar pola lantai berdasarkan cerita tersebut!

3. Tari Lego-lego yang berasal dari Pulau Alor Provinsi Nusa Tenggara Timur. Tarian ini merupakan tarian yang dimainkan oleh laki-laki dan perempuan secara melingkar dan bergandengan tangan.

a) Ukurlah panjang jari-jari dengan menggunakan penggaris!

b) Hitung luas bangun datar tersebut!

4. Sebutkan 3 jenis pembentuk pola lantai berdasarkan jumlah penari!

5. Adel, Emin, Fadil, Rendi, dan Rizki mereka sedang menarikan sebuah tarian yang berasal dari Papua yaitu Tari Sajojo. Pada saat pembukaan posisi mereka menari secara berturut adalah Emin dan Fadil berada di depan. Sementara Adel, Rendi dan Rizki berada di belakang. Pola yang terbentuk seperti berikut.

a) Apa nama bangun datar tersebut?

b) Hitunglah keliling bangun datar!

Figure 3. Test questions prepared by one of the teachers

In the picture above, the teacher integrates numeracy content (using measurements) on the floor pattern material in dance. In this material, students practice regional creation dances by realizing that the movement patterns they do are actually geometric and measurement patterns that are part of numeracy content.

3. Integration of numeracy content in science subjects (Grade 5, heat transfer material)



Figure 4. Student worksheet on Science compiled by one of the teachers

In the picture above, the teacher integrates numeracy content (estimates numbers) on the heat transfer material. In the student worksheet above, students are invited to study heat transfer cases, for example basking in the morning sun, while learning numeracy about time (hours) and associated with the representation of fractions.

Furthermore, based on the results of interviews, study of teaching equipment documents, and video analysis of teacher learning practices, data obtained that 2 teachers have met three indicators of creative teachers, 12 teachers have met 2 indicators of creative teachers, and 2 teachers have met 1 indicator of creative teachers.

CONCLUSIONS

Based on this research, the best flow of training on the numeracy learning approach is as follows:

1. **In service training-1** (can be done both face-to-face and online), with the following materials:

- Introduction to learning numeracy
- Identification and Analysis of Basic Competencies or Learning Outcomes that can be linked to numeracy learning. For example, in the subject of Cultural Arts and Crafts, there is material on regional dance creations, the floor pattern in this material is very suitable for integrating numeric content.

c. Presentation of good practice examples of numeracy integration in subjects other than mathematics, such as Social Sciences, Natural Sciences, Cultural Arts, Indonesian Language, and other subjects.

d. Preparation of lesson plans, teaching materials, and student worksheets for learning practices.

2. On the job training

a. Learning Practices, according to the learning tools that have been prepared.

b. The teacher conducts interviews to explore student wellbeing.

3. In service training-2

a. Reporting the results of learning practices by teachers

b. Suggestions and recommendations for improvement of subsequent training activities, as well as follow-up plans.

- Teachers, with their creativity, are able to make lesson plans, teaching materials, and student worksheets in applying numeracy across the curriculum approach with guidance during training activities.
- Teachers are able to creatively carry out learning with numeracy across the curriculum approach in accordance with the lesson plans that have been prepared.
- When elementary school teachers pay attention to numeracy in subjects other than mathematics, it can actually increase students' understanding of these other subjects.

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