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Unfolding the Practical of Numerical Literacy for Specialist in Teaching Mathematics

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ABSTRACT

This research aims to explain the typical rationale design of mathematics education research for a teacher to become a specialist in teaching mathematics. The structure shows learning environment as a natural way to address the teachers in their primary role and as the approach for effectively improving mathematics teaching - which is a didactical situations-based teaching model, illustrating how the model can be applied in real life by drawing from processes inherent in mathematics in a concrete case, turning out from a genetic view of mathematics, and relates to the consequences for teacher education in demanding special mathematical courses for teachers. That is a method by which the students acquire knowledge and skills more than in the past and acquire themself, delivering subject matter to develop their abilities. The main question formulated: What are the basic but practical teaching methods that can scientifically support the development of students to the expected goals? The teachers get two instruments: providing opportunities and stimulating individual growth. The result is students with an excellent foundation to penetrate mathematically in all matters, and the phenomenon of numerical literacy will be enlightened in terms of skills. In this case, students are no longer tuned to receive knowledge passively but to acquire it actively. For this reason, the characteristic of teaching methods is not instruction and reception but organization and activity.

Keywords: *Rational design, Specialist, Didactical situation, Genetic view of mathematics.*

1. INTRODUCTION

The research is to unfold numerical literacy to the foundations of mathematics education analysis and its implications for educators at the graduate and magister levels. Numerical literacy has room to grow while the researcher advances pedagogy and curriculum [1]. The argumentation is that the discursive nature has a nontrivial effect on students' views of mathematics—a significant component of numeracy [2,3]. For most students, educators would attend to the notes (and words) they use.

When educators choose textbooks for the courses, a critical examination of the text is likely absent from the numeracy process. However, its presence within a research setting [4] suggests that a quantitatively literate individual should work with numbers. While [2,3] argues the dispositions and their view of the cultural literacy of mathematics. Additionally, [5] and [6] say that literacy should also be in the sense that a student should have the ability to use "mathematical knowledge as part of a process of problem-solving and development" [5].

A tendency to appraise mathematics and use the subject is *not* equivalent to the type of materials fostered through attending to the *etymological sense of meaning*. For example, to prove is equal to describing as wide as possible by thinking. In particular, when teaching quantitative literacy, consider how educators place their students as choices to provide a level of autonomy in deciding what mathematics should learn and how they learn it. However, [7] marked the seminal twenty-first-century plea for numeracy at all levels. That begins with the notion that the world is "awash in numbers" and proceeds to note that it is not mere mathematics that students need to succeed, but rather the tools of quantitative literacy [7]. He continues arguing that numeracy enables one to participate in other disciplines, such as computer science. This participation is not simply rhetoric but is in connections between numeracy and literacy in quantitative studies, for example, linked numeracy with better problem-solving [8].

The critical view of the *etymological sense of meaning* is not novel in work outside of mathematics; it uses vital analysis, of which systemic functional linguistics forms the backbone [9, 10]. There are three *systemic* meta-functions through which numerical literacy operates: interpersonal, conceptual, and textual. For example, a fraction is an abstract operation and a concrete or semi-concrete one. The revelation is that there is a patterned function behind the etymological. While, Kress and Hodge [11] note that language (etymological meaning), whether spoken or written, serves as a "medium of consciousness for the students, its form of consciousness externalized." And [12] agrees, noting that "Language is the primary means for the transmission of culture from one generation to the next." Educators (their notes or textbooks) pass on the "culture" of the discipline by applying this notion to mathematics and numeracy.

Additionally, because historically, mathematics and mathematics education has systemically excluded people of color, the working class often communicates mathematics in manners differently from traditional mathematics [13]. Language can perpetuate the marginalization of historically oppressed groups. It may be that a group that systemically excludes from mathematics will face more significant challenges in developing numeracy. For example, the elimination method is to change or manipulate, not eliminate, mathematics expression.

Our mathematics texts are to find the positioned readers differently, i.e., the text recruited students to a "yet unknown, esoteric" subject of mathematics [14] and the text that apprenticed students to "a non-intellectual occupation" by presenting problems as they would found in the real world. For example, students performed calculations, and putting answers was structured as an algorithm report. While the second one, its presentation for participation in the public domain". That is subtly discouraged students from involvement in careers that did not require mathematics. This suggested mindset is problematic because it is not necessarily the case that the student desires a "non-intellectual" future.

Performing the method of Fairclough, [15] concluded a typical word problem taken from a reform-oriented calculus text. Her research grew from a concern about the fidelity of mathematics reform efforts. In analyzing the problem, noted that "The interpreting student positioned as a student of mathematics who has access to the use of the mathematics register and the assumptions associated with the word problem genre" [14]. The analyzed problem was considered the real-world type within the text and founded on efforts to foster numeracy.

In contrast to the analytical frameworks of [14] and [15], [16] used a "nonreactive technique" called content analysis, aiming for less subjective analysis. They began by coding for ways in which a value might manifest in the text then objectively searched the reader (or notes in this research) for codes. Their findings included the texts' emphasis on "control over progress," "mystery over openness," and "specialism over accessibility" [16]. The texts' esoteric portrayal of mathematics bolsters the findings of [14] and [15]. Moreover, if one assumes that students accept the construction, that other mathematics texts that students encounter are similar, then relating the findings to numeracy, it is plausible that students will view mathematics as immutable and irrelevant to their lives. For example, symbolic representations need technology in understanding problems.

Furthermore, [17] examined the "voice" in a reform-oriented mathematics text series. In her analysis, she found no first-person pronouns within the team, arguing that such an "obfuscation of agency" within the text portrays mathematics as a discipline that can act independently of humans. Her findings suggested that, notwithstanding the goals of the curriculum, "how powerful the hegemony of traditional forms of mathematics in curriculum materials can be" [17]. This finding bolsters Seah and Bishop and furthers [14] and [15] findings concerning authority. Those are the problem of previous texts.

In another research, [19] analyzed "stance bundles" within mathematics classrooms to see how teachers positioned themselves and students [18], as cited in [17]. They noted that some stance bundles permit choice while others discourage latitude [18]. Altogether, these authors suggest that, regardless of curricular goals, mathematics texts tend to position students with little choice, a position at odds with developing numeracy. However, the texts must contain rich representations and more algorithms. For example, by verification and justification when doing math based on numerical literacy.

Therefore, [20] did the skills for Life curriculum, an obligatory set of standards for adult numeracy education. She saw value in critical analysis of the subtleties infidelity of the reform goals, focused on how the text constructed the ideal reader, and the study included the teacher's place within the text. She found that the text built the perfect reader of the text as the numeracy teacher, and in turn, constructed for the teacher the ideal student. It positioned the student with little independence, excluding them from academic mathematics. She noted that "Numeracy learners could present, not within a deficit model as passive and without agency, but as highly motivated, self-directed adults who bring a variety of numerate practices to their learning that can celebrate and developed" [20]. One of independent thinking is in using numbers [21].

2. METHODOLOGY

That was a way of bridging mathematics and numerical literacy to reason quantitatively, understand the subject method, and acquaintance with the achievement. The argumentation is that numeracy subsumes in literacy and within the context [22]. The researchers offer a way of bringing order into the conceptual confusion surrounding students' numeracy. The way is framework and concepts arranging along of increasing levels of achievement.

There are three phases in unfolding the practical of numerical literacy, i.e., formative, mathematical, and integrative. These are in a framework of the development that showed the level of numeracy concept [23]. The levels were analyzed statistically according to the phases. In the formative stage, mathematics' content and skills for purpose and application, and numeracy is a skill deemed to be arithmetic. In the mathematical phase, numeracy includes numbers, algebraic, geometric, statistical thinking, and problem-solving based on mathematical knowledge. And, in the integrative, numeracy was in incorporating everyone's mathematics with and problem-solving.

The unfolding study conducted between 2015 and 2020 tested an instructional approach or intervention, used an outcome measure that assessed mathematics and numeracy skills, and employed comparison groups. Those are 15 studies conducted by the researchers related to students' numeracy. Data were analyzed using different permutations of students' achievements.

3. RESULTS AND DISCUSSION

The use of technology helps students develop their mathematical skills and understanding. That focused on students' needs and the capabilities of the technology itself. The skills enhance students' thinking and build their versions of numerical literacy.

This research compared three teaching methods: computer-assisted (using calculator and software), tutoring using educators' notes, and traditional teaching (using standard textbooks). Subjects (n = 30) were members of existing classes. There was no significant difference in mathematical achievement among the three groups, although the computer-assisted group gained 1.9-grade levels while the traditional group gained 1.1. However, computer-assisted students were significantly better in mathematics than those in the conventional group.

There is a significant difference in numerical literacy skills between the class and the traditional or control (lecturers' notes and textbooks). Of the 74 students assigned to the traditional group, 15 % (n = 11) remained at the post-test; 32 percent of the 135 students in the numerical literacy (experimental) group (n = 43) completed the program. In addition, there was differential attrition, with more of the control group staying to completion, which clouded the results. However, it might be argued that the more excellent retention of the experimental group indicated higher student satisfaction with the instruction.

The research also evaluated the numerical literacy program that compared computer-assisted instruction and educator-implemented instruction in numeracy. The researcher randomized the students into three groups of eight students. There is no difference in improvement between the teacher-led intervention and the computer-assisted instruction. The students and instructional approaches are like those in courses.

The study measured the gains in *etymological sense* and numeracy skills in two classes. Six students received traditional teaching, and another six used Numerical Literacy Workshop, Math Concepts and Skills, and Computer Assisted Learning (CAL) software packages. The results show significantly more outstanding achievements were made in the *etymological sense of meaning* (word meaning, word action, and comprehension) and numeracy (mathematical concepts, operations, and applications) under computer-assisted instruction than traditional instruction. During the same time, the students who received traditional teaching made no gains in the *etymological sense of meaning* skills and showed a slight decline in mathematics performance, i.e., in developing the statement of proof.

Overall, the results are presented and described in Tables 1, 2, and 3.

Table 1. Description, outcome, and effect of the formative phase

Design	Results		
	Description	Outcome	Effect
Assignment for two groups	Using computer-assisted instruction	The achievements were not significantly different	Not observable
The impact of skill and drill	Using tutorial software	No significant difference between the two groups	Getting *etymological sense*

Design	Results		
	Description	Outcome	Effect
The effect of the curriculum. in the literacy levels	Using the ordinary course by post-test	The is no difference in achievement between the groups	More effective when the subjects have good entry-level in arithmetic
Giving questions	Traditional versus computer-assisted instruction	Students using computer-assisted instruction were significantly better than in the control group.	More definitive results
The traditional classroom instruction versus computer-assisted instruction	The competency levels	The result indicates that the average level change is for computer-assisted instruction.	Can be compared between grades for non- computer-assisted instruction
A literacy project and enrolled in traditional classes	A literacy project in the intervention group and traditional classes	That project showed a higher average gain compared to the traditional	Indicate the literacy
To compare computer-assisted and implemented instruction in numeracy	An experiment of computer-assisted and educator-implemented instruction	There is no difference in improvement	Educator-led intervention

Table 2. Description, outcome, and effect of mathematical phase

Design	Results		
	Description	Outcome	Effect
To assess the effectiveness of literacy skills	Computer-assisted instruction compared with traditional education.	There is an effect on the traditional classes.	The traditional class' student reminded at the post-test and completed the program.
To compare three teaching methods	computer-assisted instruction, tutoring using numeracy materials, and traditional teaching.	There was no significant difference in mathematical achievement among the three groups	The computer-assisted instruction group gained grade levels more than the traditional one
To compare students in conventional settings	supplemented by computer-assisted instruction.	No significant difference in skills gained.	regular instruction
To study the effect of computer-assisted instruction	a group of pre-numeracy and a numeracy group.	Founded that there is no significant difference in those achievements.	Observable achievement
To compare the effects of	A computer-based numeracy drill and a traditional workbook drill and practice	tests were not significantly different.	class on retention

Design	Results		
	Description	Outcome	Effect
To study the effect of	computer-assisted instruction - supplemented program on pre-numeracy and the numeracy	Eighty-six percent (86%) of the students advanced in level	opposed to a 50% gain in any control group
To teach a developmental mathematics course,	a class was taught and compared with the same lesson taught in a previous without the approach.	Students in the experimental class performed better on the outcomes.	The experimental method was effective in improving mathematics performance.

Table 3. Description, outcome, and effect of integrative phase

Design	Results		
	Description	Outcome	Effect
To study the impact of tutoring	in algebra class	significant improvement in achievement	in the intervention group
To examine the effectiveness of	a traditional (control) and algebra instruction (experiment)	There was no statistically significant difference in achievement between the two groups	In discovering algorithms, exploring algebraic manipulation, and identifying misconceptions
To teach algebra	in two classes, one for the experiment and the other is traditional (control)	founded no significant difference between the experimental and control groups,	neither based on algebra could be compared the achievement of the two groups
To examine the effect computer-assisted instruction and in math laboratory	participating in the mathematics course	the transference of mathematical concepts learned through a computer to paper-and-pencil tests	manipulation for promoting the problem-solving ability
To explore the applicability methods to	the teaching of geometry concepts.	is significantly increased	For teaching students' performance
To describe a diagnostic and tutorial program	The design of a diagnostic test testing,	a significant effect of the experimental group the program	norm at the grades is equivalent.

4. CONCLUSION

Based on the teaching effect discussed in the results, it is highlighted that this research reflects a haphazard and disorganized approach to studying numerical literacy and is not guided by any technique, theory or school of thought about good mathematical pedagogy. Furthermore, it does not provide comprehensive knowledge about the impact of literacy interventions. With only 15 studies examining mathematical interventions, almost all of them related to the use of textbooks or notes in teaching, researchers can consider this research a meaningful guide to direct future efforts in practice or research. Researchers discovered how learning and education interact with these differences in numeracy development. In addition, this study examines teaching for adult learners, particularly numerical literacy based on how educators think numeracy in the classroom, exploring instructional approaches and their impact on learners.

Many factors come together to challenge anyone trying to sum up what numeracy is. The scope of skills and literacy and the shortcomings of current assessment methods depend on several points of view in the beholder's eye. The educational contexts in which adults engage with numeracy-related topics vary widely given the diversity of backgrounds or learning objectives. Meanwhile, the concept of numeracy goals and competencies will be developed and influenced by various stakeholders.

AUTHORS' CONTRIBUTIONS

The contributions are that the researchers already used numerous teaching and learning approaches in flexibility and observed it. We also ask other lecturers to demonstrate their numeracy skills through experiences and knowledge.

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