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Harnessing Indigenous Basketry Resources for Prenumber and Early Number Work

Clement Ayarebilla Ali[1] & Ernest Kofi Davis[2]

[1] Department of Basic Education, Faculty of Educational Studies, University of Education, Winneba, Ghana

[2] School of Educational Development and Outreach, Faculty of Education Studies, University of Cape Coast, Ghana

Correspondence: Clement Ayarebilla Ali, Department of Basic Education, Faculty of Educational Studies, University of Education, Winneba, Ghana. E-mail: ayarebilla@yahoo.com

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Abstract

Even though basketry is an age old occupation in Ghana and the world over, it appears mathematics tasks and activities involving the designs and structures have remained unnoticed and inadequately tapped for early school instructions. This qualitative survey therefore, purposively sampled four teachers, two basket artisans and six pupils in the Bolgatanga Municipality of Upper East Region of Ghana to harness, discuss and apply the tasks and activities indigenous basket resources could be employed to enhance conceptual knowledge and understanding in prenumber and early work. The findings showed that apart from providing employment and income for local artisans, teachers and pupils were equipped with prenumber activities that lead to the acquisition of early number work in pre-algebra, pre-geometry and pre-statistics tasks and activities in mathematics. We therefore, recommended instructional policies and programmes that promote and improve upon conceptual learning of prenumber and early school mathematics with indigenous resources.

Keywords: early number, indigenous basketry, prenumber, tasks and activities

1. Introduction

Research (Westbrook, Durrani, Brown, Orr, Pryor, Boddy, & Salvi, 2013; Clements & Sarama, 2009) opines that indigenous knowledge thinking emerged from the social-behaviourism works of Thorndike (1911), Pavlov (1927) and Skinner (1957) who scientifically proved the laws of stimulus-response, and classical and operant conditioning in the processes of administering rewards and punishments for learning and/or unlearning. These modes of learning gave credence to the emergence of observation and imitation strategies (apprentice-master model), and informed lecturing, demonstration, rote learning, memorisation, and choral repetition pedagogical approaches.

The next viable support to indigenous knowledge was the promulgation of constructivism based on the work of Piaget (1896-1980) which theorised the mind as inherently structured in the environment to develop concepts and acquire language as the individual learners actively participate by exploring the environment to build existing cognitive structures (schemas). And when these schemas are adequate to deal with a new situation or problem, learning is said to occur through assimilation, but when existing schemas are not adequate enough, then accommodation is required to modify the existing schemas. These notions bore fruits to informed child-centredness, activity method, and learner-centredness pedagogical approaches (Westbrook et al., 2013; Beaty, 2012; Clements & Sarama, 2009).

The third discovery of indigenous knowledge and the most widely acknowledged conception emerged from the mathematical thoughts of Vygotsky. The mathematical thoughts of Vygotsky opine that knowledge is socially constructed and mediated through socio-cultural tools from learners' immediate environment (indigenous knowledge). In this perspective, the teacher sets up a Zone of Proximal Development to bridge the gaps between what the learners can cope without any support and what the learners can learn with minimal support system (Westbrook et al., 2013; Breidlid, 2009; Clements & Sarama, 2009; Chaiklin, 2003). These strategies informed student-teacher, student-student, group work, discussion, project work and learning community pedagogical approaches.

It is therefore fascinating to observe that, indigenous people of Northern Ghana and many developing countries has little knowledge about the basketry indigenous resources and their impact on prenumber and early number work. The first problem originates from lack of available records and literature to support indigenous artefacts that conceptualize, concretize and indigenize early mathematical conceptions. Where there existed research works in even advanced European and American cultures, it still remains unclear how teachers and pupils in developing countries like Ghana can transform and change their long existing occupations to advance prenumber and early number knowledge and skills in mathematics (Davis & Chaiklin, 2015; Beaty, 2012; Shuttleworth Foundation, 2007; Yazzie-Mintz, 2007; Mosimege, 2004; Gerdes, 2003).

Secondly, indigenous technologies of the people of the Upper East Region of Ghana evolved around weaving (baskets, hats, and mats), leather work (bags, purses, and bracelets), blacksmith (hoe, cutlass, arrows and spears) and textiles (smock and kaba). Weavers in particular usually design and construct mathematics-oriented baskets, hats, emblems, decorations, ornamentals, necklaces, earrings and buttons that involve alot of mathematics (Davis & Chaiklin, 2015; Wemegah, 2014; Davis, 2013). However, the basketry experiences little technological advancement, transformation and innovation. Thus, these eye-catching and flamboyant-looking artifacts still remain dominant objects of traditional and customary decorations.

Thirdly, a research by Wemegah (2014) estimates that over ten thousand people actively engaged in basketry with diverse implications growth and development, vis-à-vis reducing north-south migration, providing employment, eliminating diseases, fighting hunger and greening the natural vegetation. However, teachers, pupils and the entire educational industry have little collaboration and consultation with the indigenous artisans to help them incorporate and adopt courses for study in the formal educational sub-sector in Ghana. For instance, it is not uncommon to see school structures, classroom designs, pupil uniforms, and school resources sparingly depicting thee local designs and structures. And even though, the term *Bolga Baskets* is very much associated with indigenous basket resources, they are conspicuously absent in formal mathematics settings that can adequately and appropriately bridge the gaps between home and school knowledge, practicalize instructions, promote school-community relationships and eschew parrot or rote learning (Davis, 2010; Balcomb, 2001).

Lastly, the indigenous baskets are woven mainly with grasses. However, with rampant bush burning and other unfriendly environmental practices, basket weavers travel long distances to buy or import the grasses. With rapid urbanization, roofing sheets are now readily available and relatively cheaper than thatch grasses, the extinction of many wild animals compel the few surviving to live in holes, coffins have gradually replaced local mats, and Western medicines are more recommended or preferred to the indigenous ones. *How do the natural forest resources still serve the indigenous people?* This means the hitherto thick grass forest no more serve any purpose for indigenous life activities. Therefore, employing indigenous basket resources to teach early number concepts would not only preserve and transfer culture but also improve indigenous technology, environment, foreign exchange, job security, local knowledge, and classroom lessons. Particularly, the use of indigenous basket resources in teaching mathematics was our effort to make teaching and learning of mathematics less of a rule-bound routine and more of engaging in real-life local situations, and eschew rote learning that does not support the development of mathematical thinking and opportunity for students to do mathematics (Davis & Chaiklin, 2015; Davis, 2013; Mosimege, 2004; Balcomb, 2001).

Vygotsky's Conceptual Framework in Indigenous Knowledge and Learning

Ever since man began to walk erectly, his hands became free to make tools in support of his livelihood: he discovered, improved, constructed, and used all kinds of artisans and handicrafts (baskets, bags, nets, pottery, and weapons) to make his life enviable to other animals. Invariably, great amount of early mathematical art and science came with these artisans and handicrafts (Ashekele, Embashu, & Cheikhyoussef, 2012; Beaty, 2012; Shuttleworth Foundation, 2007; Yazzie-Mintz, 2007; Gerdes, 2003). Sheya & Grange (2014), Sieber & Hatcher (2012), Smith-Brillon, Marshall-Peer, Smith, Linkert, & Brown (2011), Dei (2008) and Bishop (1988) enumerates the mathematical thinking processes in early number work, namely measuring, locating, playing, counting, designing, and explaining that come with all cultures and indigenous knowledge in a quest to secure baselines for identifying and exploring early mathematical concepts and activities to facilitate learning, arouse curiosity, and encourage discovery.

The second conceptual framework adduced from Vygotsky is the methodologies of integrating African indigenous knowledge from artisans, teachers and learners by Emeagwali (2014), Ashekele, Embashu, & Cheikhyoussef (2012), Emeagwali (2013), Adefarakan (2011), Chilisa (2012), Yazzie-Mintz (2007), and Dei (2008). For instance, Gerdes (2014) studied the *adinkra* cloths in Ghana, baskets from Botswana, and *buba* blouses from Yoruba in Nigeria established possibilities of integrating indigenous knowledge in the classroom.

Particularly, Smith-Brillon et al. (2011) modelled indigenous basket knowledge in the classroom that builds strong school-community relationships, improves socio-economic lives, ensures active participatory, and develops local content in the curriculum.

The third conceptual facet comes from Gabrielson & Hsi (2012), Adefarakan (2011), and Yazzie-Mint, (2007) who are ubiquitous with the Ghanaian culture and occupation. Teachers, pupils and parents in the Upper East Region of Ghana may and should use basket for indirect mathematical activities such as storing, transporting, and serving food (Wemegah, 2014; Beaty, 2012). It is therefore, practicable and possible to conceptualize and situate indigenous basket resources to prenumber and early mathematics knowledge to ensure cultural continuity, transfer of indigenous technology and pedagogical proxies.

2. Methodology

The purpose was to engage artisans, teachers and pupils to share their knowledge and experiences on the indigenous basket resources and generate socio-cultural classroom discourses that apply prenumber and early mathematics instructional discourses. The phases of the research were introduction, statement of the problem, research questions, data collection, analysis, and discussion of findings from the demographic information, narrative to interviews, pictures of baskets, and mathematical concepts intertwined in the indigenous baskets (Alakananin & Liu, 2013). The study began by following ethical issues of seeking permissions and ensuring anonymity of the responses (Cohen, Manion, & Morrison, 2007).

The research design was purely qualitative study. Ritchie & Lewis (2003) agree that there are no clearly defined rules and procedures for analysing qualitative data. Therefore, the researchers implored qualitative narrative analysis with tables, pictures, and conversations to come out with the findings. The study targeted teachers, pupils and basket weavers of the Bolgatanga municipality in the Upper East Region of Ghana. A sample size of twelve respondents was obtained by accessibility sampling technique to suit the scarcity of the population and eliciting in-depth interviews with requisite respondents.

The instrument of data collection was both secondary (pictures) and primary (interviews). The reliability and validity of the discussions still remained intact despite the small size of the sample. The questions were simple, straightforward, and self administered. Various prompts, probes, clarifications and other motivations were employed in the interviews. Based on the exploratory nature of the research questions and the fact that indigenous basket resources are culturally embedded, the interview guide was adopted to address the perceptions and judgements of the teachers and artisans to accomplish the aim of this research (Sheya & Grange, 2014; Abrams, Taylor, & Guo, 2013; Alakananin & Liu, 2013; Balcomb, 2001).

The analysis of the tables, conversations, and pictures from the respondents were restyled and recontextualized on the applications of indigenous basket resources for teaching and learning early number work to make indigenous baskets a lifelong occupation based on emerging scientific and technological advancements and engage pupils in practical mathematics discourses by employing the following two research questions:

1) What views do artisans and teachers hold on utilization of indigenous basket resources on prenumber and early mathematics tasks and activities?

2) How do indigenous basket resources help in discovering prenumber and early mathematics discourses?

3. Results

Tables 1 and 2 are conversations of the artisans and teachers on the utilization of indigenous basket resources on prenumber and early number mathematics tasks and activities.

Table 1. Background information on artisans

Artisan	Education	Occupation	Weaving	Position	Common Baskets
A	Primary school	Weaver and seller	15 years	Owner	All kinds
B	Primary school	Weaver and seller	20 years	Owner	All kinds

Source: Interviews with artisans in 2016.

The Table 1 provide education level, occupation, work experience, position and common indigenous basket resources of two artisans in the Bolgatanga Municipality. It was discovered that both artisans' highest academic level was primary, self ownership of companies, work between 15 and 20 years, and weave all kind of baskets. Below were dialogues that were transcribed from the two artisans.

Conversation with Artisan "A"

Question: Are you satisfy with your work in this industry? Briefly explain your response.

Artisan "A": *Not so good. There are now so many people in the business. We no more get enough sales except during trade fairs*.

Question: Do teachers of educational authorities buy baskets here? Briefly explain your response.

Artisan "A": *Yes but once in a while. The teachers mainly buy the sandals. It is rather tourists who patronize our baskets*.

Question: Do your wards send baskets to school?

Artisan "A": *No. They rather prefer the leather bags and materials. They say they have no use of them in school. The leather bags are used to contain their books and water*.

Question: Do you teach your wards how to use baskets to learn in school?.

Artisan "A": *No. Except when they want to use the baskets to send food to school for "Our Day"*.

Question: How would you encourage teachers and educational authorities to come and buy the baskets?

Artisan "A": *I have never spoken to them. But I will do it if the opportunity avails itself. Even some education directors owe some basket shops in this vicinity, and have never told us to send baskets to the schools*.

Question: Give your own comments or concerns in this basket industry.

Artisan "A": *It is good, this business has helped me travel out of Ghana, cater for my kids' school, and many others for the past 15 years. It is especially good if you get a contract*.

Conversation with Artisan "B"

Question: Are satisfy with your work in this industry? Briefly explain your response.

Artisan "B": *Somehow, But the market has not been moved to the new site. This has lowered our sales*.

Question: Do teachers of educational authorities buy baskets here? Briefly explain your response.

Artisan "B": *Some buy and yet others purposely come to learn about our tradition and culture*.

Question: Do your wards send baskets to school?

Artisan "B": *Some use and send them to school. Others are just lazy to carry them*.

Do you teach your wards how to use baskets to learn in school?.

Artisan "B": Yes. I do sometimes at home and other times in my work place.

Question: How would you encourage teachers and educational authorities to come and buy the baskets?

Artisan "B": *I teach them the traditional and cultural aspects of the artefacts so that they come and buy. Question:*

Question: Give your own comments or concerns in this basket industry.

Artisan "B": *the baskets are now available everywhere. This has limited our opportunity for good market and sales. I would like to look elsewhere for another sales point to complement*.

The above conversations were ample evidences to show that artisans had little knowledge about the impact of their indigenous basket technology to the teaching and earning of mathematics and must be educated to design, construct and manufacture basket resources that appropriately addresses pupils' learning needs in their own environments (Gerdes, 2014; Abrams, Taylor, & Guo, 2013; Beaty, 2012; Abrams, Taylor, & Guo, 2013; Breidlid, 2009).

Table 2. Background information on teachers

Teacher	Highest Education	Rank	Level	Teaching Experience	Favourite Topics	Common Materials
A	Senior High School	Pupil Teacher	Nursery	2 years	Factorization	Text books
B	Diploma	Senior Supt.	Primary 3	10 years	Addition, subtraction	Bottle tops, sticks, stones
C	Post Diploma	Assist. Director	Administrator	50 years	Fractions, equations, measurements	Fruits, furniture, designs
D	SHS	Pupil teacher	Primary 3	2 years	Fractions, Percentages, handling data	Counters, sticks

Source: Interviews with teachers.

The Table 2 shows the background information of four teachers in the Bolgatanga Municipality who had their highest educational levels ranged from senior high school (SHS) to the university, two novice and two experienced teachers. That is, two novices as well as two experienced teachers who were interviewed indicated that indigenous basket resources can be used to teach and learn factorizations, addition, subtraction, fractions, measurements, and handling data. They mostly used text books, counters, fruits, and classroom designs for teaching, and made the following comments as transcribed by the researchers.

Conversation with Teacher "A"

Question: What common teaching and learning materials do you use for teaching your favourite topics?

Response: *Textbooks and Pam files*.

Question: Do you know that baskets are useful for teaching all concepts in mathematics?

Response: *No, because I have never seen nor heard about it. This is my first time*.

Question: Does your school authorities buy local materials for you to teach mathematics in your school?

Response: *No, may be the school authority has no idea about it*.

Question: Do your pupils bring baskets to school or use them for learning?

Response: *No*.

Question: In your own view, if you use baskets to teach mathematics, how do you think your pupils/students would perform>

Response: *They will perform better than the previous, because it is practical*.

Question: How would you encourage schools and educational authorities to bay baskets?

Responses: *By public education*.

Question: Give your comments or concerns in this industry.

Response: *It will bring a great development to the nation and region. Also, create employment for the youth*.

Conversation with Teacher "B"

Question: What common teaching and learning materials do you use for teaching your favourite topics?

Response: *Bottle tops, sticks, stones and more.*

Question: Do you know that baskets are useful for teaching all concepts in mathematics?

Response: *Yes, because in teaching all concepts in Mathematics, baskets are needed for putting most of the teaching materials inside so that it can be used next time again*.

Question: Does your school authorities buy local materials for you to teach mathematics in your school?

Response: *No*.

Question: Do your pupils bring baskets to school or use them for learning?

Response: *No*, *they use polythene bags*.

Question: In your own view, if you use baskets to teach mathematics, how do you think your pupils/students would perform?

Response: *My students will be happy to see you putting some of the materials in it*.

Question: How would you encourage schools and educational authorities to bay baskets?

Responses: *I will encourage them to buy for their schools to help teachers and students to be able to store some of the teaching materials in it*.

Question: Give your comments or concerns in this industry.

Response: *They should try to produce more baskets into the system*.

Conversation with Teacher "C"

Question: What common teaching and learning materials do you use for teaching your favourite topics?

Response: *fruits, empty containers, tables, chairs, classroom walls*.

Question: Do you know that baskets are useful for teaching all concepts in mathematics?

Response: *Yes, They can be used for measurement, fractions, e.g., 1/2, etc*.

Question: Does your school authorities buy local materials for you to teach mathematics in your school?

Response: *No*.

Question: Do your pupils bring baskets to school or use them for learning?

Response: *No*.

Question: In your own view, if you use baskets to teach mathematics, how do you think your pupils/students would perform?

Response: *They will find ways of using them in various through their own creativity and discovery through practice.*

Question: How would you encourage schools and educational authorities to bay baskets?

Responses: *By impressing upon them that the baskets are useful and can be of great help in teaching maths. The children themselves will discover ways to use them in various topics*.

Question: Give your comments or concerns in this industry.

Response: *Baskets are beautiful things that can be used in many ways. They can be used for decoration, as containers, as teaching and learning materials, gifts for friends, as exports to give the country foreign exchange and many more*.

The seemingly inability of some teachers to demonstrate indigenous baskets impact on the teaching and leaning of prenumber and early mathematics was affront to natural justice and social disadvantage. The world has adopted local resources in teaching and learning mathematics, and Ghana cannot be left behind! We therefore, went further to restructure various shapes, textures and structures of indigenous baskets to help the teachers to indigenize their classroom instructions and demonstrate the required tasks and activities with their pupils in the classroom.

Indigenous basket resources of Figure 1 were adopted to address pupils' conceptual understanding in prenumber and early mathematics themes. The themes range from prenumber work, early counting activities, pregeometric knowledge and introduction to handling data, which are all requisite requirements for the four basic operations in arithmetic.

Figure 1. Indigenous basket resources (Credit: Wemegah, 2014)

The Figure 1 above shows different forms of basket resources of weavers of Bolgatanga Municipality that pupils engaged in to come out with prenumber and early number and activities. The prenumber activities comprised sorting, comparing, matching, ordering and counting.

a. *Sorting*: The pupils sorted the artefacts according to shape, colour and size involving the following activities:

1). Gathering all artefacts that are made up of only grass materials.

2). Separating the artefacts according to big, medium and small sizes.

3). Separating the artefacts objects according to hemisphere, prism and pyramid.

4). Separating the artefacts according to single and multiple colours.

5). Separating the artefacts according to open, semi-open and closed ends.

b. *Comparing*: The pupils compared the artefacts by employing the senses of seeing, feeling and measuring skills involving the following activities:

1). Putting artefacts in groups or sets of defined quantities.

2). Describing the artefacts with the phrases more than, less than, much more than much less than, longer than, shorter than, bigger than, smaller than, larger than, and so on.

3). Measuring the lengths of the artefacts and determining which are longer or shorter.

4). Counting the number of artefacts in the groups and determining which groups have more or less numbers.

5). Describing the relative quantities in three or more sets and determining which sets are much more or much less than the given sets.

c. ***Matching***: The pupils matched the artefacts by pairing or associating two or more sets involving one-to-one, one-to-many, many-to-one and many-to-many pairs of the following activities:

1). Putting equal number of artefacts and their names for pairing to discover one-to one mapping.

2). Putting two artefacts on the left and names of solid shapes to the right to discuss the concept of one-to-many mapping.

3). Putting many artefacts on the left and two closed shapes on the right to discuss the concept of many-to-one mapping.

4). Putting equal number of artefacts on both left and right with different shapes and colours to discuss the concept of many-to-mapping.

5). Discussing the relevance and significance of matching artefacts in relation to the numbers left unmatched or the numbers matched more than.

d. ***Ordering***: The pupils ordered the artefacts according to magnitude and quantity of two or more sets involving the following activities:

1). Arranging similar artefacts according to height in both ascending and descending patterns for pupils to *conserve the concept of height.*

2). Arranging similar artefacts according to size in both ascending and descending patterns for pupils to conserve the concept of size.

3). Arranging similar artefacts according to number in both ascending and descending patterns for pupils to conserve the concept of number.

4). Arranging dissimilar artefacts according to the same number for pupils to conserve the concept of sameness, as much as, as little as and equal to.

5). Arranging dissimilar artefacts according to the different number for pupils to conserve the concept of differences, more than and not equal to.

e. ***Counting***: The pupils counted the artefacts according to parroting, enumerating, picking and gaming.

1). Counting numbers by rote in terms of rhythms, riddles and puzzles.

2). Counting numbers by sets in terms of number names.

3). Counting numbers by picking artefacts and matching with number names.

4). Counting numbers by deigning games with the artefacts.

5). Counting numbers and writing numerals on the artefacts.

The early number work comprised Pre-algebra, pre-geometry and pre-statistics activities with the artefacts.

a. ***Pre-algebra***: The pupils performed pre-algebra activities that lead to successful classroom discourse in addition, subtraction, multiplication and division.

1). Grouping and counting with artefacts.

2). Naming numbers and numerals on artefacts.

3). Comparing numbers and numerals with artefacts.

4). Ordering numbers and numerals with artefacts.

5). Describing sums, differences, quotients and dividends of numbers and numerals with artefacts.

b. ***Pre-geometry***: The pupils performed pre-geometry activities that guide the classroom discourse in shape and space.

1). Grouping and measuring the artefacts with non-standard units of the solid figures.

2). Classifying and measuring with standards units of the plane figures.

3). Sorting and dissecting the artefacts according to open, semi-closed and closed figures.

4). Outlining and measuring artefacts according to the formation of lines, curves and angles.

5). Forming and measuring artefacts according to vertices, edges, faces, area, volume and capacity.

c. ***Pre-statistics***: The pupils performed activities that transition the discourses into collecting and handling data with the following activities:

1). Collecting and gathering artefacts with the same shape and texture.

2). Collecting and counting artefacts with different shape and texture.

3). Ordering and tabulating artefacts with different shape and texture.

4). Counting and analyzing artefacts with different shape and texture on frequency of occurrences.

5). Counting and representing frequency of occurrences with piles of same artefacts.

4. Discussions of Findings

In exploring the mathematical value and appreciation of indigenous artefacts for prenumber and early work, the use of indigenous basket resources in teaching mathematics was our effort to make teaching and learning of mathematics less of a rule-bound routine and more of engaging in real-life local situations. We particularly discovered that pupils were meaningfully comparing, tracing, playing, drawing, sorting, matching, describing, measuring, counting, designing, and explaining. These activities instilled discovery and deep learning and ultimately impact on the teaching and learning of pre-algebra, pre-geometry and pre-statistics at the early years of mathematics education. The pre-algebra lead to the discourses in conservation of number, counting numbers, naming numbers, symbolizing numbers, ordering of numbers, classifying of numbers, adding numbers and subtracting numbers. The pre-geometry lead to discourses in solid shapes which are made up of cylinders, prisms,

pyramids, cones and spheres; plane shapes which are made up of circles, parallelograms, kites, trapeziums, rectangles, triangles, circles and angles; and measurements of mass, weight, capacity, money and length. The pre-statistics lead to the conception events of numbers, occurrences of numbers, gathering of numbers, serializing of numbers and description of numbers.

Also, most pupils primarily learned prenumber and early number work through instructional approaches that emphasize on rote memorization of algorithms. However, Rote learning does not support the development of mathematical thinking and conceptual understanding but rather takes away the opportunity offered to students construct and solve mathematics problems. The threats of examination failure and/or withdrawal of students from schools if they score below a certain minimum pass mark compel early school mathematics pupils to use rote learning and these practices limit the ability of teachers and pupils to secure suitable resources in the environment to teach and learn mathematics. Indigenizing basket resources would help make teaching and learning meaningful, practical and self-motivational.

In addition, indigenous basket resources place the ownership of mathematics to the doorstep of teachers and pupils and give opportunities to pupils to recognize and appreciate the logic of mathematical thinking. The fundamental themes in early basic school mathematics are number, numeral and arithmetic which offer advanced opportunities for pupils to connect the four basic operations of addition, subtraction, multiplication and division. Indigenous basket resources place teaching and learning through problem solving, and allow pupils to manipulate and explore visual models and interactive manipulatives in early number work. In this regard, mathematics does not only become a gatekeeper of life opportunities but also a solid foundation to confidently and competently build knowledge upon. This ultimately promotes and yields the long term and advanced goals involving mathematics conjectures and hypotheses, proves and disproves, abstract thinking, fluent computation and communication. If teachers inculcate the habits of employing indigenous basket resources for prenumber and early number work in basic schools, pupils will definitely acquire conceptual and meaningful procedural knowledge with knowledge and skills of dynamism, engaging, socialization.

Lastly, Ghana has recently embarked upon curriculum reforms to improve upon academic performance at all levels of education, through learner-centred and activity-based approaches. It is therefore envisaged that indigenous basket resources would allow teachers and pupils to relate, situate and contextualize teaching and learning within and around local settings and pupils' way of life. This is because in the interviews with the basket weavers, it was indicated that their knowledge and skills have been passed on to their children and that ensures continuity of the baskets. However, some teachers lack the indigenous technology and their usefulness in prenumber and early number work. Therefore, such curriculum reforms should ensure that teachers and pupils would not only acquire indigenous technology but also formalize that technology to boost local industry and provide employment.

5. Conclusion and Implications for Practice

The study emanated from the experiences of Ghana's efforts to integrate indigenous resources into mathematics education. From the interviews, we realized that we need alternative ways of making teaching and learning of Mathematics more attractive and interesting to early school pupils. Even though the sample size was not large, stakeholders should accept the collaboration with local artisans to harness the indigenous basket resources enhance conceptual understanding in prenumber and early number work.

The use of indigenous basket resources in teaching mathematics was our effort to make the teaching and learning of mathematics less of a rule bound routine and more of engaging in real-life local situations. We continue to try new ways of harnessing indigenous resources for the teaching of mathematics in a view to contributing practically in Ghana's drive towards indigenization, industrialization and mathematization. However, the findings show that comprehensive pedagogical methods on prenumber and early number work needs to be rolled out, where resources can be championed by local artisans and schools use only indigenous resources for the prenumber and early number mathematics instructions.

Secondly, the findings of the teachers' responses show that teachers are appropriately placed to indigenize mathematics knowledge and experiences inside and outside the early formal classroom. We recommend that early mathematics teachers should improvise foreign materials with the indigenous basket resources to close the already widening gaps between artisans and teachers on matters of indigenizations of basketry in classroom instructions.

Thirdly, it is undeniable fact that the forest cover has depleted significantly in recent times. The Metropolitan, Municipal and District Assemblies of Ghana should consider collaborating with the Ministry of Education and

Ghana Education Service to domesticate the wild grasses and preserve basket weaving grasses in order to provide the needed raw materials to feed the indigenous basketry industry that manufactures indigenous basket resources for prenumber and early number work for teaching and learning.

Lastly, stakeholders should consider organizing award ceremonies, greening pageants and fairs in grass cultivation, basket weaving, and indigenous knowledge to promote collaborations and markets for the indigenous basket industry. Scholarship packages to wards of artisans could be a novelty in this regard. In addition to improving prenumber and early number mathematics pedagogy and learning outcomes, these packages would generate local knowledge and improve local technology beyond prenumber and early number work.

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