

NATIONAL NUMERACY PROGRAMME (NNP)

*Developing strong foundations in
Mathematics for all children to succeed*



**RESEARCH REPORT ON
USE AND VALUE OF
LEARNER WORKBOOKS
IN MALAWI PRIMARY
SCHOOL MATHEMATICS**

Mercy Kazima, Fraser Gobede & Justina Longwe

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EXECUTIVE SUMMARY

The National Numeracy Programme (NNP) is a Government of Malawi programme led by the Ministry of Education and funded by UK aid from the UK government. The goal of the programme is to improve student learning outcomes in mathematics in standards 1-4, so that girls and boys have a solid foundation in basic skills to finish schooling and to fulfil their potential. The NNP is a national programme that will ultimately reach all primary schools in Malawi.

Central to the approach of the NNP are learner workbooks that have been developed for each term of standards 1-4. The expectation is that each learner will have their own workbook and that these will be used to structure the teaching and learning of mathematics at a rate of approximately one page a day.

The learner workbooks were piloted in 223 schools during the 2021-2022 academic year with each learner in standards 1-4 receiving one workbook per term. This is the first time that learner workbooks are used in Malawian schools. Traditionally, textbooks have been used. It follows that this change raises questions regarding the use and value of the workbooks, and, in particular, whether the benefits of investing in learner workbooks rather than textbook are sufficiently significant to warrant the effort and cost involved. These questions have prompted the research being reported on here. The research was guided by five key questions: (i) What are teachers' and learners' preferences between workbooks and textbooks? (ii) What are the benefits that teachers and learners experience through using the learner workbooks? (iii) What concerns do teachers and learners have in relation to the learner workbooks? (iv) What are the benefits and/or concerns related to the NNP's philosophy in relation to other theories of teaching and learning mathematics, and (v) How do the education managers view the workbooks?

Data were collected from three sets of participants; learners, teachers and managers. In total 153 learners and 64 teachers from nine schools in two zones close to Zomba participated in the study. At each school, researchers

administered a written questionnaire to the teachers, and conducted focus group discussions (FGDs) with two groups of learners, one from standard 3 and another from standard 4. In addition, there were a total of 25 managers drawn from all three regions of Malawi. The managers, interviewed by the researchers, included District Education Managers (DEMs), Primary Education Advisors (PEAs) and head teachers. The interviews and focus group discussions were all audio recorded. All the data were transcribed and entered into a spreadsheet then analysed using ATLAS.ti software.

Findings are presented in six parts; (1) learners and teachers preferences between workbooks and textbooks, (2) the benefits of learner workbooks that learners and teachers experience, (3) concerns that learners and teachers have with regard to the learner workbooks, (4) how the benefits and concerns relate to the vision of the NNP, (5) managers' views on the workbooks, and (6) misconceptions that the research has identified in relation to the workbooks.

1. Learners and teachers preference between workbooks and textbooks

Most of the learners and teachers indicated that they prefer workbooks. In total 86% of learners and 77% of teachers prefer workbooks over textbooks.

The reasons learners gave for preferring workbooks was that every learner has own workbook; they are challenged to work with larger numbers in comparison with the current textbooks; they are being encouraged to make sense of situations and use “their own methods to solve the problems;” being able to take the workbooks home and doing mathematics at home; and, the workbooks being in English which provide learners the opportunity of learning English while doing mathematics.

Reasons that teachers gave for preferring workbooks included each learner having their own book and the efficiency associated with teachers not having to write all the work on the board for learners to transcribe before they can get started with the mathematics of the lesson and, learners taking the workbooks home to do homework and think about the work for each day in advance were significant benefits. In addition, they mentioned that textbooks are typically not available to learners anyway

The main reason(s) that learners gave preferring the textbooks was that the content is easier (cognitively less demanding) than the content of the workbooks, the textbooks work in lower number ranges, and show procedures for the tasks (activities). The reason teachers gave for favouring textbooks was also that the textbook is easier for the teachers and the learners to use because it gives examples and a single procedure to follow.

It is interesting to note that the reasons that learners and teachers cite for preferring textbooks (low number ranges and rigidity in the procedures to be used) are expressly the bottlenecks to greater achievement in mathematics that the NNP is addressing.

2. The benefits of workbooks that learners and teachers experience

Of the many benefits that learners and teachers reported experiencing with the workbooks, the most common from both teachers and learners were: (i) learners having their own workbooks had increased learner participation and motivation in mathematics, (ii) they provide an effective mechanism for monitoring the progress of each learner, (iii) it saves time writing on board and learners copying, (iv) they encourage the use of a wide variety of strategies and skills, (v) they encourage reasoning and problem solving, and (vi) learners are able to do mathematics outside of class time.

3. Concerns that learners and teachers have with regard to the learner workbooks

There were two concerns common to both teachers and learners, namely that they experienced the tasks (activities) as too difficult for some learners, and, that there were sometimes insufficient workbooks for all of the learners in a class or school.

Other concerns that teachers expressed included how they felt that there was too much work on a page, how some parents completed the pages before the lesson; and, there are no workbooks for special needs learners. Learners also expressed concerns about their teachers' practices, these include that some teachers make them follow one procedure and ignore the learners own strategies and methods; some teachers get wrong answers or mark wrong

answers correct and correct answers as wrong, and, that some teachers do only first two tasks (activities) on the page.

4. How the benefits and concerns relate to the vision of the NNP

Most of the benefits identified through this research align well with the underlying philosophy of the NNP, namely, developing mathematical knowledge with understanding, that can be applied in unfamiliar situations all the time reasoning about what it is that one is doing. These characteristics are derived from the so-called strands of Mathematical Proficiency: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and a productive disposition (Kilpatrick, Swafford & Findell, 2001).

Teachers' concerns are, for the most part, not mathematical and can be resolved within schools. The common concern about too much work on a page has already been addressed by the NNP by providing a written document to schools with suggestions for teachers (see Brombacher, 2022a).

Learners concerns about teacher practices run the risk of stunting learners' development of mathematical proficiency. It is important the programme works on including strategies that develop both teacher' content knowledge and pedagogical content knowledge. That said, the fact that learners can identify wrong answers suggests that they are learning with understanding which is encouraging.

5. Managers views about the workbooks

All of the managers reported that they like the workbooks. The main reason they gave was that each learner has their own book which encourages participation.

The key concerns raised by the managers had to do with sustainability. They expressed concern over what will happen with the provision of workbooks when the donor funding ends. That said, they all indicated that they would budget for and supply the learner workbooks if they had enough funds.

6. Misconceptions that the research has identified in relation to the workbooks

Analysis of all the responses from learners, teachers and managers has revealed some misconceptions specifically about the learner workbook as well as the NNP programme in general. These include: (i) with the introduction of the workbooks learners no longer need notebooks for mathematics, (ii) if a learner does not have a workbook then the learner can do no work, (iii) a page should be completed within a 30-minute lesson, (iv) all workbooks should be marked, and (v) learners don't need to show their thinking but only their answers. Although these misconceptions are not directly linked to the research questions, it is important to record these for the attention of the programme.

In conclusion, the research findings show that workbooks are beneficial to nature of mathematical learning that underpins the NNP approach, namely, developing mathematical knowledge with understanding, that can be applied in unfamiliar situations all the time reasoning about what it is that one is doing.

The findings suggest that there is a strong case to be made for learner workbooks.

The researchers recommend that the use of workbooks be continued and rolled out to all schools during the scale-up phase and beyond. It goes without saying that doing so has financial implications and these will need to be confronted by the MoE and donor community.

INTRODUCTION

Brief background and research questions

The National Numeracy Programme (NNP) is a Government of Malawi programme led by the Ministry of Education and funded by UK aid from the UK government. The goal of the programme is to improve student learning outcomes in mathematics in standards 1-4, so that girls and boys have a solid foundation in basic skills to finish schooling and to fulfil their potential. The NNP is a national programme that will ultimately reach all primary schools in Malawi.

The National Numeracy Programme (NNP) aims at strengthening the teaching and learning of mathematics in the first four years of primary school in Malawi. The focus of the programme is on developing knowledge with understanding, the ability to apply that knowledge in unfamiliar situations as well as to reason about (explain) what you are doing.

Central to the approach of the NNP are learner workbooks that have been developed for each term of standards 1-4. The expectation is that each learner will have their own workbook and that these will be used to structure the teaching and learning of mathematics at a rate of approximately one page a day.

The workbooks were piloted during the 2021-2022 school year, with the plan being to roll out the programme to all schools (5 700) over the next two school years.

Workbooks are new in Malawian schools. Previously, only textbooks have been used. Consequently, there have been questions raised regarding the use and value of workbooks, and whether the investment into the development, production and distribution of the learner workbooks makes sense. These questions have prompted the research that is being reported on here.

The research was guided by the following research questions:

1. What are teachers' and learners' preferences between textbooks and workbooks?

2. What are the benefits that teachers and learners experience from using the learner workbooks?
3. What concerns do teachers and learners have about the learner workbooks?
4. How do the benefits and concerns relate to the NNP's philosophy and approach? And,
5. How do the education managers view the workbooks?

The literature on the use of workbooks (e.g. Fleisch et. al, 2011, Hoadley, et. al., 2016, and Mathews et. al., 2014) indicates that workbooks in general and mathematics workbooks in particular have been found to be beneficial to learners. It is likely that the benefits identified in the literature would also apply to Malawian learners. That said, it was nonetheless necessary conduct research in Malawi on whether the NNP workbooks are of benefit to children's learning of mathematics in Malawi.

Methodology

Purposeful sampling was used to select two zones close to Zomba and a total of 9 schools from the two zones. From each school, learners, teachers and head teachers were included as participants in the research.

Teachers: all of the teachers in the sample schools that taught standards 1-4 in the 2021/22 academic year were asked to complete a written questionnaire (Appendix A). All the teachers in each school were included to get rich as rich a set of data from each school. The questionnaire was administered to all the teachers at each school in one sitting. The teachers were asked to gather in one room where the researcher explained the purpose of the questionnaire and thereafter they completed the questionnaire individually. In total, 64 teachers (Table 1) completed the questionnaire.

Table 1: Distribution of teachers in the sample

	STD 1	STD 2	STD 3	STD 4	TOTAL
Zone 1	6	7	7	9	29
Zone 2	8	10	10	7	35
Total	14	17	17	16	64

Learners: Two focus group discussions with between 8 and 12 Standard 3 and 4 learners were conducted at each school. Selection of the learners was done by the class teachers and included an equal numbers of boys and girls. Each group sat down with a researcher who conducted (and recorded) the focus group discussion using a discussion guide (Appendix B). In total, 153 learners (Table 2) participated in the focus group discussions.

Table 2: Distribution of learners in the sample

	STD 3	STD 4	TOTAL
Zone 1	46	44	90
Zone 2	32	31	63
Total	78	75	153

Managers: data was also collected from District Education Managers (DEMs), Primary Education Advisors (PEAs) as well as head teachers. The head teachers were the head teachers of the 9 schools in the sample, while the other managers were selected from across the regions in Malawi. The interview was conducted using an interview guide (Appendix C) and was either audio recorded or written using WhatsApp texts. In total, 25 managers (Table 3) participated were interviewed for the study.

Table 3: Distribution of managers in the sample

	SOUTH	CENTRE	NORTH	TOTAL
District Education Managers	3	1	1	5
Primary Education Advisors	6	3	2	11
Head teachers	9	0	0	9
Total	18	4	3	25

All the data were analysed. First, by transcribing the audio into text and then entering it into an excel spreadsheet. Codes were developed based on a reading of the data. The data was further analysed using ATLAS.ti qualitative data analysis software, to identify all the benefits and concerns emerging in the data including their frequencies. The software was also used to categorise benefits and concerns into that were speaking to the workbook, those that

were speaking to the NNP programme, and those that addressed other general issues.

FINDINGS

Research question 1: What are teachers' and learners' preferences between textbooks and workbooks?

Both learners and teachers were asked to indicate whether they preferred textbooks or workbooks, and to give reasons for their preference.

Teachers responded by checking either workbook or textbook on the questionnaire, and then provided their reasons by means of a free-response field.

For learners, the question was posed to them in Chichewa by the researcher conducting the Focus Group Discussion (FGD). Each of the learners in the group was asked to individually state their preference and the researcher tallied the responses. The reasons for the preferences were discussed as a group and audio recorded.

Learners' preferences

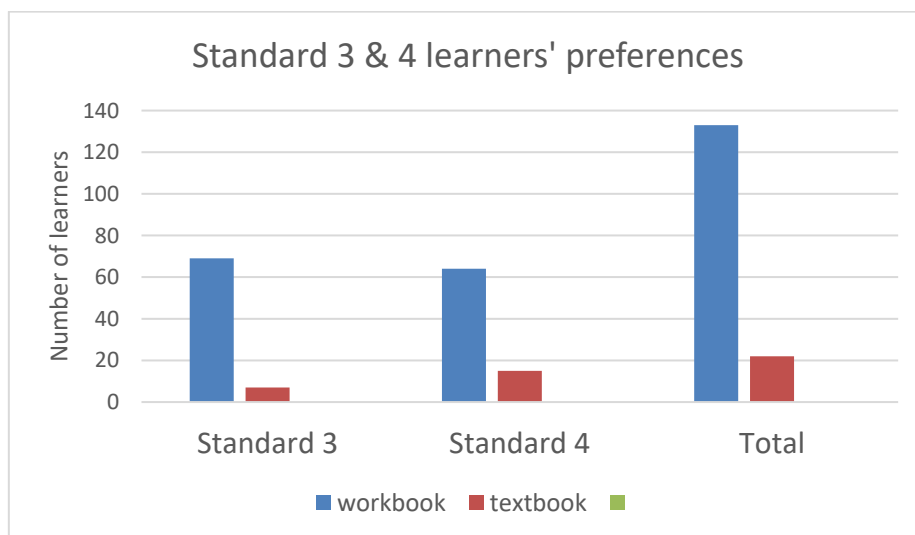


Figure 1: Learners' preference between workbook and textbook

86% of the learners prefer workbooks over textbooks while 14% prefer textbooks (Figure 1).

Learners' reasons for preferring textbooks

The main reason that learners stated for preferring textbooks was that the content of the textbook is easier than the content of the workbooks.

Learners' went on to say that the textbooks tend to give an example before the exercise as well as showing procedures for completing the exercises/activities. Textbooks also make explicit the operations to be used e.g. addition or subtraction, and, textbooks have typically use a lower number range.

It interesting to note that that these are precisely the issues that the NNP aims to address: increasing the typical low number ranges, developing problem solving skills and reasoning as well as setting higher expectation of learners.

Learners' reasons for preferring workbooks

There were five main reasons that the learners gave for preferring workbooks over textbooks. Figure 2 illustrates the number of FGDs that each was mentioned in.

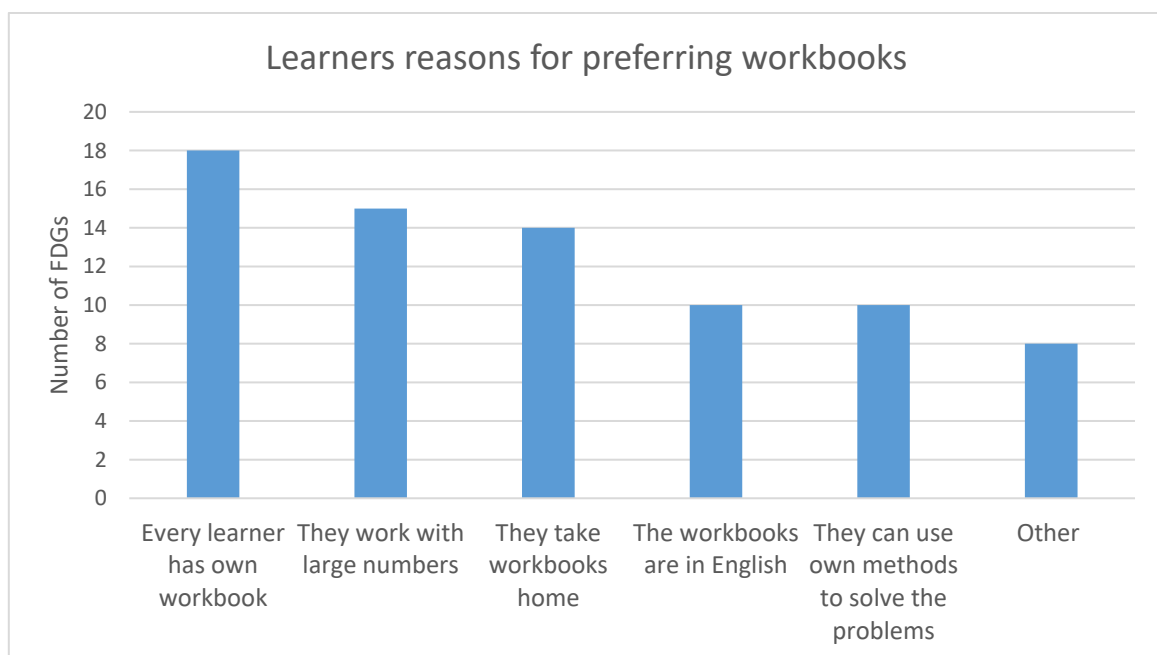


Figure 2: Learners' reasons for preferring workbooks

The most common reason for preferring workbooks was that each learner has their own workbook. This was mentioned in all 18 of the FGDs.

The next most common reason was that the workbooks expect learners to work with larger numbers. This was in comparison with the textbooks which typically have much lower number ranges. One group explained that “... *with exposure to large numbers in the workbooks, we can also work with large sums of money during everyday activities such as being able to differentiate K5000, which looks similar to the K20 note*”. These higher number ranges in the learner workbooks reflect the increased expectations that the NNP curriculum has for learners.

Being able to take the workbooks home and doing mathematics at home, as well as the workbooks being in English which provides learners the opportunity of learning English while doing mathematics, were the next most common reasons mentioned by the groups of learners.

Another common reason was that the workbooks allow the learners to use their own methods to complete tasks (activities). The learners explained that unlike textbooks where there was a single method to follow, the workbooks do not dictate the method. One group explained as follows: “*Workbooks do not make us repeat the same thing over and over again. We always encounter new challenging problems, and we think of how to solve them.*”

There were many other reasons each mentioned by just one or a few of the focus groups, these were classified as ‘other’. The complete list is provided in Appendix D.

Teachers' preferences

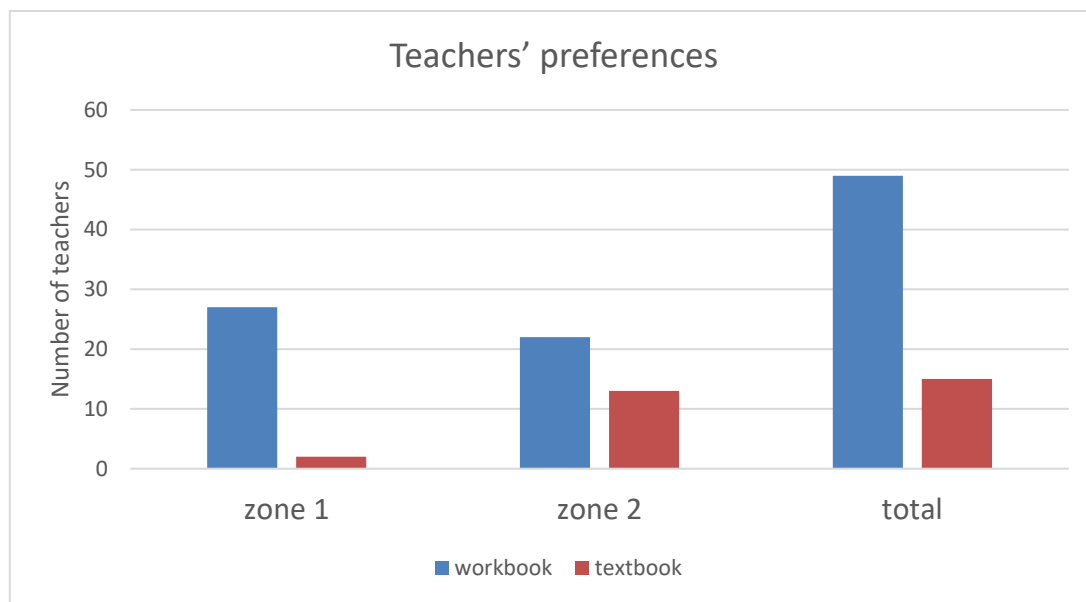


Figure 3: Teachers' preference between workbook and textbook

The overwhelming majority of teachers prefer workbooks over textbooks (Figure 3). This is more pronounced in the zone 1 schools than in the zone 2 schools.

Teachers' reasons for preferring textbook

Three key reasons emerged from the free responses of the teachers on the questionnaire.

First among the reasons was that the textbook is easier – easier for the teachers to teach with, and easier for the learners to do the work. To be clear, “easier” refers to a reduced/lower cognitive demand. As with the learners, teachers who held this view explained that the textbook gives examples before exercises, and specify a single procedure to be used.

The second reason cited by teachers was that textbooks are easier to care for because they are kept by the school and not by the learners.

The third reason teachers gave was that with the textbooks learners are not able to know the work for the day in advance because the textbook does not arrange the work on the basis of a page per day. It is surprising that some teachers consider this as a negative. Interestingly, learners having access to

the mathematics content for the term’s lessons in advance was considered by other teachers as a reason for preferring the workbook.

Teachers’ reasons for preferring workbook

Teachers’ reasons for preferring workbooks could be classified into six main reasons (figure 4) The category of ‘other’ include reasons mentioned by just a few teachers, for example only one or two teachers mentioned that “*marking is easy*”.

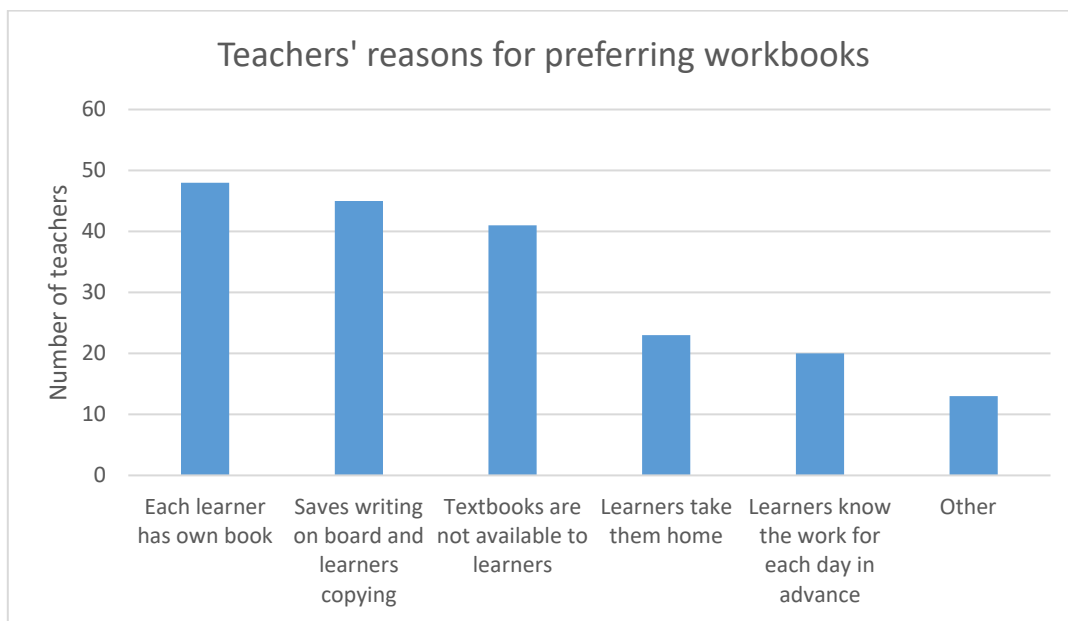


Figure 4: Teachers’ reasons for preferring workbook

As we can be seen in the Figure 4, the most common reason given by the teachers is that learners have their own (work)book. This aligns well with the reasons given by the learners where every learner having their own book was the most common reason for preferring workbooks mentioned by all of the focus groups. This feedback highlights that there is value in learners having their own workbooks.

The next most common reason cited by teachers was in relation to the time associated with writing problems on board and learners copying these down that is typical of textbooks. Not having to do so with the workbooks increases efficiency and allows more time for the teachers and learners to focus on mathematics.

The workbooks being readily available (unlike textbooks), and learners taking them home were also common reasons among the teachers for preferring the workbook. Related, learners having the workbooks at home and knowing in advance the mathematics for the next lesson was also a common reason mentioned by some teachers. The teachers explained that learners can start thinking about the mathematics in advance and come to class prepared.

Research question 2: What are the benefits that teachers and learners experience through using the learner workbooks?

Both learners and teachers were asked to describe the benefits they experienced from using textbooks and workbooks, and to give reasons.

Benefits experienced by learners

Six themes emerged through the learner FGDs. These can be classified as reasons that have to do with the workbooks themselves and others that speak to the programme more generally.

Benefits associated with the workbooks

1. Ease of access and use

Ease of access and use of the workbooks was one of the key benefits that was frequently mentioned by the majority of learners. Learners stated that with the workbooks each one of their own copy. And, having their own copy enabled learners to take the workbooks home, giving them more time to do the mathematics and to reach out to their parents for help if and as needed.

Almost all of the learners mentioned the “ease of use” of the workbooks as one of the major benefits. They explained that since the tasks are already printed in the workbooks, they just have to complete the tasks (without first having to transcribe them from the board); and because they work in pencils, they can easily erase and repair mistakes. For the learners, this makes the learning of mathematics easier (less burdensome) than it was before the introduction of the workbooks. This nature of the workbooks also makes them accessible to young learners. In one of the discussions with Standard 4 learners, they pointed out that since Standard 1 learners cannot write with confidence, completing the tasks directly into the workbooks helps a great deal.

2. Shapes and illustrations

Learners mentioned how the workbooks have activities that involve shapes¹. And, how they get excited when they are asked to compare different shapes and to create new shapes using these shapes. In addition, they also enjoyed the geometry activities that involve tracing their solutions to the tasks.

In relation to the illustrations, learners mentioned that they not only enjoy the illustrations, but that the illustrations are also a valuable resource for completing the tasks (activities) on a page. The illustrations encourage learners to think about the tasks (activities) and record their responses according to the way they understand the question.

3. Skip counting

Many learners also mentioned that using the workbooks has taught them the value of skip counting. Such as in 2s, 5s, 10s, 20s, 25s, 50s, and 100s.

4. Exposure to English

The use of English was one of the most frequently mentioned benefits of the workbooks. Learners described how the workbooks help them to learn English while doing mathematics and how much they enjoy this. One of the focus group described how their increased familiarisation with English as a result of working in the mathematics workbooks will support their learning when they go to Standard 5 where all learning is done in English.

Benefits associated with programme more generally

5. Promotion of critical thinking and problem solving

That the workbooks promote critical thinking was expressed in different ways by the learners. Learners indicated that the workbooks promote thinking through both the nature of the tasks (activities), the way they are presented, and, the different possible approaches to completing these. Regarding the nature and presentation of different types of tasks (activities), learners commented that in the workbooks they encounter different types of operations

¹ Space and Shape (Geometry) activities

within the same set of questions. In one FGD, a learner stated that: “*Timapezamo masamu osiyanasiyana... monga ngati ma tayimusi, kuchotsa, kuphatikiza ... gawanso*” [We find different kinds of mathematics...such as multiplication, subtraction, addition, and even division].

Some learners identified the use of the number line as one benefit that can be directly attributed to the introduction of the workbooks. Unlike with the use of textbooks where they are expected to do addition and subtraction in one way only, the number line enables them both to visualise the calculation(s) and provides them with a tool for doing the calculations

Another aspect of the programme (supported by the workbooks) has to do with the approach to solving mathematical problems. Some learners liked the approach of going straight into solving problems before being exposed to worked example. One learner expressed the benefit of not starting with worked examples in relation to examinations where there are no worked examples.

6. Large number range

Learners also mentioned how the programme and the workbooks are exposing them to larger numbers, which, in turn, prepares them for the work that they will be doing in higher standards.

Benefits experienced by teachers

Teachers’ responses to the questionnaire indicated a range of different benefits that they associate with the workbooks. These can be classified as reasons that have to do with the workbooks themselves and others that speak to the programme more generally.

Benefits associated with the workbooks

1. Increased learner motivation

Teachers explained that learners having their own workbook has increased the learners’ motivation and participation in mathematics lessons. Some teachers went as far as to say that that increased learner motivation has

contributed to a decrease in absenteeism because the learners do not want to miss out on a workbook page(s).

2. Easy monitoring of learners' progress

Teachers explained that since each learner completes the workbook pages individually, it is easier for teachers to monitor the individual progress of each learner by looking through the pages of his/her workbook. And, being able to monitor the progress they are better able to respond to the needs of the learners in their class. Parents, they mention, can also monitor their children's progress.

3. Saves time writing on board and learners copying

The teachers again described how before the workbooks teachers had to write the work on the board and learners had to copy it into their notebooks before they could even start working on it. This took up a lot of the lesson time. By contrast, using the workbooks resulted in more work being done on a day.

4. Doing mathematics outside of class time

Another benefit that the teachers described was how having workbooks allowed learners to practice at home or at other times outside of class time.

5. Learners are learning English

Teachers, like the learners, mentioned how having the workbooks in English is helping learners learn English as they learn mathematics. Learners, they noted, will benefit from their increased command of English when they get to the higher standards where all instruction is in English.

6. Planning

Teachers explained since the workbook are designed to be used at a rate of one page a day, the pages of the workbook guide the teachers on what to do in each lesson which in turn helps with preparation.

Some teachers went as far as to say that the help the workbooks provide to teachers with planning has reduced teacher absenteeism because teachers want to avoid falling behind in the workbook pages.

Benefits associated with programme more generally

7. Variety of strategies and skills,

Teachers explained that through the programme and the workbooks they have learnt to use a wide range variety of strategies with which to complete tasks (activities).

They also expressed surprise and excitement at the way in which the programme deals with more than one concept on a day which, in turn, develops a more robust interrelated understanding of the concepts.

8. Encourages reasoning and critical thinking.

Teachers described how the problem solving nature of the materials promote learners' reasoning and critical thinking. Application of mathematics to everyday situations has encouraged learners to select and use different strategies on their own.

9. Gives learners confidence to work with big numbers

As with the learners, teachers also mentioned working in a larger number range as a benefit of the workbooks and the programme more generally.

Research question 3: What concerns do teachers and learners have in relation to the learner workbooks?

Learners' concerns with the workbooks

Learners' responses during the FGDs identifies different concerns that they associate with the workbooks. Concerns such as the difficulty of the workbook tasks, legibility of workbook pages, and their teachers' practices when using the workbooks have to do with the workbooks themselves While concerns related to the availability of the workbooks speak to the programme more generally.

Concerns associated with the workbook

1. Difficulty of workbook tasks

Learners mentioned that some activities (tasks) in the workbooks are relatively hard (cognitively demanding) for them to complete, and sometimes

this is true even for the teachers. Some learners attributed the difficulty of the tasks to their limited understanding of English whereas others pointed to the mixing of different operations, such as addition and subtraction, in one set of activities (tasks) on the same page.

That said, some learners were quick to point out that the activities in the workbooks are not the problem, but rather that the learners themselves are the problem. One learner identified the source of the difficulty being that some learners are used to counting in ones when doing calculations, an approach that does not work well with the large numbers used in the workbooks. The learner explained as follows:

Vuto lina, eti? La ma workbook anthu oti akawapatsa samu yoti 1000 kuphatikiza ndi cha? 2000, amayamba kuwerenga ma wani ma wani, kuti afike awona break yakwana, [some draw and count in ones and that takes time because workbook has large numbers. For example to add 1000 and 2000, some can start drawing the ones ... up to break time they are not finished ...]

The discussion suggested that the issue of the difficulty of workbook tasks is debatable. With some evaluating the tasks as difficult, while others are of the view that the activities (tasks) are not difficult but that the problem is in how some learners approach them. Relatedly, learners from another FGD pointed out that workbook tasks are particularly difficult for newcomers who were not previously exposed to the workbooks in their previous school. Some explained that although the tasks in workbooks are difficult, they become easier as the learners get more used to them, and, as the tasks become more familiar. For example one group said: “*ntchito ya workbook ndiyovutirako . . . zimakhalako bwino pokhapokha tikazolowera [problems in the workbook are more difficult (than textbook) . . . they become better only when used to them]*”. This suggests that the initial difficulty learners experience with the activities (tasks) reduces with time and increased familiarity with what is expected of learners.

2. Legibility of workbook tasks

Learners also mentioned issues related to legibility of the pages of the workbooks. The objects in some of the counting illustrations are small and hard to count (in ones)².

Some learners reported that the dimensions of some of the shapes in the workbooks do not match the sizes of the shapes that the learners have³. For instance, the dimension of the learners' shapes can be larger than the shape drawn in the workbook.

3. Teachers' practices

Learners expressed frustration/concerns with teachers who restrict them to a particular strategy to be used when working on the workbook activity (task). In one FGD learners said: *“Madam pena ife tikakhala kuti talemba masamu mmene ifeyo tinangoganizira kuti tilembe, iwo amanena kuti ati tilembe samu mu njira imene iwo akufunira kaya yochotsa kaya yophatikiza, amatiuza choncho koma ife timakhala kuti talemba kale.”* [Madam sometimes tells us to write again a problem using a specific method after we have already solved using our own method]

Other teacher practices relates to the use of the workbooks that learners identifies as concerns include:

- teachers sometimes getting the answer wrong,
- teachers marking correct answers as incorrect,
- teachers not knowing the answers,
- teachers promise to revisit the activity (task) later on but not doing so,
- teachers not marking work,

² It is a deliberate design feature of the workbooks that the individual elements of collections of object, for example the individual bananas in a collection of ten bananas are difficult to count in ones. This is to encourage learners to count the bananas in the groups of ten that they are arranged.

³ This is largely attributable to the fact that parents make the shapes for the children using a template provided by the NNP and locally available materials such as cardboard. And, the manufacturing process is not efficient and/or accurate.

- teachers not reviewing work so that learners understand what they did wrong.

All these concerns about their teachers' practices suggest that the learners are interested in learning mathematics. However, they feel that they are being constrained by their teachers.

Concerns associated with the programme

4. Distribution of workbooks

In one FGD, the learners reported that sometimes there are insufficient workbooks for each learner to get a workbook at the beginning of the term with a number of learners only getting their workbooks a few weeks later. They explained that it is difficult to follow the lesson without a workbook.

Teachers' concerns of the workbooks

Teachers' responses to the questionnaire indicated a range of different concerns that they associate with the workbooks. These can be classified as concerns that have to do with the workbooks themselves and others that speak to the programme more generally.

Teachers' concerns with the workbooks

1. Workbooks have too much work on a page

Teachers consistently reported that there is too much work on a page for a single (30 minute) lesson. This concern was not surprising, it has been raised by many teachers since the pre-pilot. That said, it should be noted that the NNP has developed a paper for teachers and schools explaining how to deal with this concern (see Brombacher, 2022a). However, since the concern continue to be raised, there is clearly a need for greater emphasis on the recommended solution(s).

2. Too difficult for some learners

Teachers reported that the workbooks are too difficult (cognitively demanding) for some learners. The difficulty was attributed to the large numbers used in the workbooks (especially the early ones), the use of English, more than one concept on a page, and, some learners getting confused when counting the

objects in the illustrations. Interestingly these are also the characteristics of the materials that some teachers and learners identified as benefits of the workbooks.

3. Care or loss of workbooks

Teachers described how when learners' workbooks are torn or lost the learners whose workbooks are torn or lost do not participate in the lessons. This is a general issue about workbook management which can be resolved by the schools.

4. Parents completing the pages before lesson

Teachers reported that some learners come to school with the pages in their workbooks already completed by their parents. This again is a general issue about workbook management which might be resolved by discussing with the parents.

Teachers' concerns with the programme

5. Special needs learners

Teachers expressed concern that there are no versions of workbooks for learners with special education needs such as large print versions of the workbooks for visually impaired learners.

6. Not enough workbooks for all learners

As with the learners, teachers reported that there were instances where there were not enough workbooks for the learners in the class/school. And, that additional workbooks took a long time to arrive, if at all.

Research question 4: What are the benefits and/or concerns related to the NNP's philosophy in relation to other theories of teaching and learning mathematics?

The greatest benefits experienced by both teachers and learners relates to the underlying philosophy of the NNP, namely, developing mathematical knowledge with understanding, that can be applied in unfamiliar situations all the time reasoning about what it is that one is doing. These characteristics

are derived from the so-called strands of Mathematical Proficiency; conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and a productive disposition (Kilpatrick et al, 2001). These are important for learners to develop and, in turn, to make sense of mathematics.

Most of the teachers' concerns are not mathematical in nature and most can be resolved by the schools. For example, that some parents complete the workbook pages; concerns about too much work on a page; and, not enough time to mark learners' workbooks are issues that have already been addressed as explained earlier (see Brombacher, 2022a, 2022b). However, if they are not tackled by the PEAs; DEMs and inspectors etc. they can have a negative impact on the successful implementation of the NNP.

Learners' concerns of teacher practices are of greater concern since these can more profoundly affect learners' development of mathematical proficiency. For example some learners indicated that their teacher forces them to use only the approach prescribed by the teacher even when the learners have developed and used their own strategies. Such practices by teachers encourage rote learning without understanding. How teachers use the workbooks in teaching is important to the achievement of NNP objectives. Learners also indicated that their teachers sometimes get the answers wrong and/or also mark the learners' correct answer as incorrect. Learners noticing that their teacher is wrong is both encouraging in as much as it demonstrates that learners are learning with understanding; and, of concern in as much as it reflects poorly on the teachers' content knowledge which is clearly below what should be expected of teachers. For the teacher, it also points to the need for careful preparation and working through the tasks (activities) on the pages in advance of each lesson.

Research question 5: How do the education managers view the workbooks?

What managers like about the workbooks

In response to the question about what they like about the workbooks, education managers gave similar responses to those that the teachers gave as reasons for preferring the workbooks. These were, for example, that learners have their own workbooks, learners' progress is easy to monitor, and using the workbooks reduces the time spent writing on and copying from board. There were no responses that has not already been raised by the teachers.

What worried managers about the workbooks

There were differences between what concerns PEAs and the concerns of head teachers and district education managers. The concerns raised by the PEAs are quite similar to concerns of the teachers, namely, that there is too much work on a page; that some learners experience the activities (tasks) as difficult; and, that sometimes there are not enough workbooks for all of the learners in the school or class. There were no additional concerns by the PEAs to those already raised by the teachers. This was not really surprising because PEAs work closely with teachers, and it is therefore likely that their experiences with the workbooks are similar to the teachers' experiences.

District education managers and head teachers' largely dwelled on their anxieties about the sustainability of the workbooks. They described how they are concerned about the sustained provision of the workbooks for all learners after the conclusion of the NNP funding. A few examples of the DEM's responses include:

“Continuity may be difficult if donors pull out because new workbooks are prepared for each term”

“Will the government of Malawi under the Ministry of Education continue to provide the workbook to every learner?”

“Will it be the responsibility of the Government to supply workbooks in the future?”

“If the programme rolls out to all schools, will the books be available to all learners, bearing in mind that even in the current expanded pilot there are already difficulties with the timely supply of the correct number of textbooks?”

All the managers (DEMs, PEAs and head teachers) said they would budget for the workbooks if they had enough funds (Figure 5).

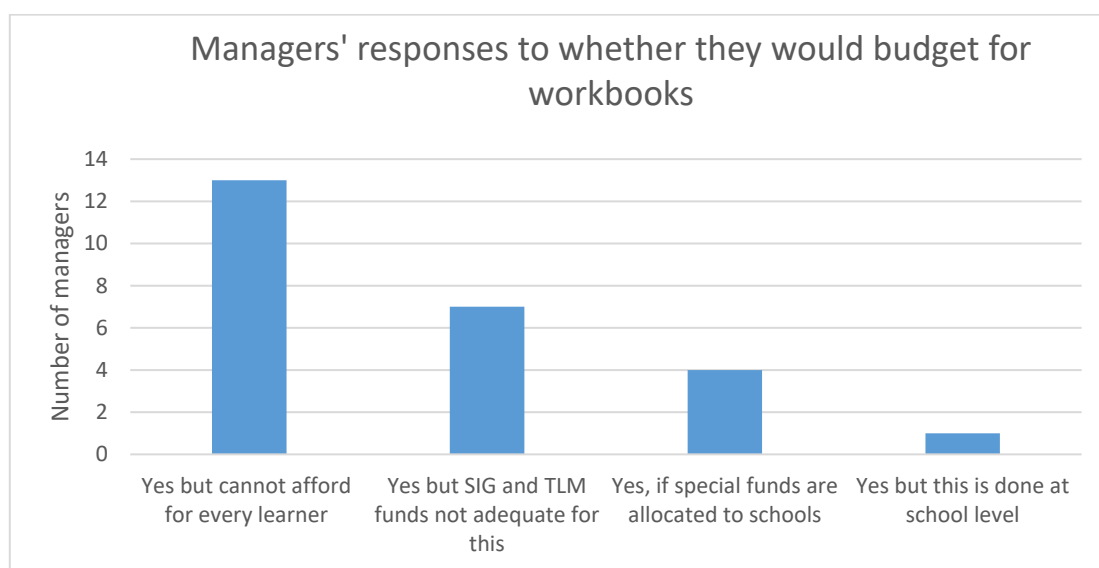


Figure 5: Managers' responses to whether they would budget for workbooks

As illustrated in Figure 5, the most common explanation for not having sufficient funds include: quite simply that they would not be able to afford to buying workbooks for every learner. Other explanations include that the School Improvement Grant (SIG) and Teaching and Learning Materials (TLM) funds that are allocated to schools are not adequate to supply the number of workbooks that need to be supplied. In summary they would all be happy/eager supply learner workbooks, if sufficient funds are allocated.

Additional finding: Some misconceptions about the workbooks

Analysis of all the responses from learners, teachers and managers revealed some misconceptions about the workbook as well as the NNP programme in general. Although these were not the target of the research questions, it is important to record these for the benefit of the programme.

1. Learners do not need notebooks for mathematics

Both teachers and learners mentioned that one of the benefits of the workbooks is that it saves parents buying mathematics notebooks for the learners. This reveals that they think that a notebook is not required in the mathematics lessons, which is not completely accurate. Learners need to have a notebook to use for recording during the teacher led activities at the start of the lesson. This misconception needs to be addressed both in teacher training activities and in parent awareness sessions.

2. If there are no workbooks then there is no work for the learner to do

Both teachers and learners mentioned that when some learners do not have workbooks they miss out on the lessons. Reasons for not having workbooks include loss, forgotten at home, new to the class, or inadequate supply. There is the need to guide teachers on how to include learners without workbooks in the lessons.

3. A page should be completed within a (30-minute) lesson

Although there has been an effort to address this (see Brombacher, 2022a), it continues to surface in most/all discussion. It is therefore clear that this matter needs greater attention at all levels of training and support of the implementation of the programme.

4. All workbooks should be marked

This is another issue that been addressed (see Brombacher, 2022b). As with the issue of a page-per-lesson this matter is raised time and again. As with the page-per-lesson issue, this matter needs greater attention at all levels of training and support.

5. Learners do not need to show their work but only answers

Some teachers mentioned that the workbooks require learners to only show their answers. This is simply not true, it is a misconception, expressly because a key focus of the NNP is to encourage reasoning learners should be

encouraged to record their reasoning in age, grade and number range appropriate ways. This is another matter that needs attention during training.

CONCLUSION

In conclusion, the research findings show that learner workbooks are making a positive contribution to developing mathematical knowledge with understanding, that can be applied in unfamiliar situations all the time reasoning about what it is that one is doing – the underlying philosophy of the NNP!

Learners each having their own workbook; being challenged to work with larger numbers in comparison with the current textbooks; being encouraged to make sense of situations and use “their own methods to solve the problems;” being able to take the workbooks home and doing mathematics at home; and, the workbooks being in English (providing learners the opportunity of learning English while doing mathematics) are benefits of the learner workbooks that were identified by all of the participants in the study.

Notwithstanding the benefits associated with the learner workbooks all of the participants also identified challenges/concerns. As much as a number of these need attention through training; general programme management; and, parent/community orientation, taken together, these do not suggest the need to rethink the use of learner workbooks. The benefits and opportunities that the workbooks provide by far outweigh any or all of the concerns/challenges identified.

The researchers recommend that the use of workbooks be continued and rolled out to all schools during the scale-up phase and beyond. It goes without saying that doing so has financial implications and these will need to be confronted by the MoE and donor community.

Each child having their own workbook for each term of the school year is a novel innovation in Malawian mathematics education, the early benefits of which are convincing.

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APPENDICES

Appendix A: Teacher questionnaire

NNP RESEARCH ON LEARNER WORKBOOKS

QUESTIONNAIRE FOR TEACHERS

Please indicate the class you taught in 2021/22

Standard 1 [] Standard 2 [] Standard 3 [] Standard 4 []

1. Before NNP:

(a) How often did you use mathematics textbooks?

Always [] Often [] Sometimes [] Never []

(b) How did your learners access mathematics textbook during lessons?

One book per learner [] One book per pair []

One book per group [] No books for learners []

2. Which do you prefer, mathematics textbooks or learner workbooks?

Textbooks [] Workbooks []

Explain: _____

3. From your experience of using the NNP learner workbooks in your class, what do you see as benefits?

4. From your experience of using the NNP learner workbooks in your class, what do you see as concerns?

5. Please write any other comment you may have about the NNP learner workbooks

Appendix B: Learners' focused group discussion guide

NNP RESEARCH ON LEARNER WORKBOOKS LEARNERS FOCUS GROUP DISCUSSION GUIDE

Zone: _____ School: _____

Standard: _____ Number of learners: _____ Boys _____ Girls _____

1. You have used these learner workbooks in standard 2/3. Before that, in standards 1 and 2, did you have mathematics textbooks?

*Chaka chatha standard 2/3 mumagwiritsa ntchito mabuku a masamu awa.
Poyamba mu standard 12 munagwiritsa nctchito mabuku awa?*

Response: Yes [] No []

Notes:

2. If yes, how accessible were the textbooks?

Ngati munagwiritsa ntchito munkatha kuwapeza mosavuta?

Response: Easily accessible [] Not so easy [] Not at all []

Notes:

3. How often were the textbooks used in class? (Establish if textbooks were used always, often, sometimes, or never).

Mabuku mumagwiritsa ntchito mu kalasi? Nthawi zonse kapena apo ndi apo?

Response: Always [] Often [] Sometimes [] Never []

Notes:

4. Which of these do you prefer? Workbooks or textbooks? Explain (establish reasons for preference or non-preference of each).

Mmene munagwiritsira ntchito, inuyo mukukonda liti limene mungafune kugwiritsa nchito.

Response: Textbooks [] Workbooks []

Notes:

5. From your experience of using the workbooks, what do you see as the benefits of the workbooks?

Mmene mwagwiritsira ntchito mubu ilili mukuona kuti ubwino wake ndi chiani

_Notes:

6. From your experience of using the workbooks, what do you see as concerns of the workbooks?

Mmene mwagwiritsira ntchito mubu ilili pali chilichonse chimene mumaona kuti sichikusangalatsani pa mabuku amenewa?

Notes:

7. Do you have any other comments about the workbooks?

Pali zina zilizonse zimene mungafune kunena za mabuku amenewa?

Notes:

Appendix C: Interview guide for education managers

NNP RESEARCH ON LEARNER WORKBOOKS

MANAGERS (HT/PEA/CEO/DEM/DEYS) INTERVIEW GUIDE

Your schools/zone/district is part of pilot and has been using NNP learner workbooks.

1. What do you like about the learner workbooks?
2. What worries you about the learner workbooks?
3. As a manager, would you budget for the learner workbooks, one per child?
4. Do you have any other comments about the learner workbooks?

Appendix D: List of all benefits of workbooks mentioned by learners

- Each learner is given a workbook to use and keep
- When asked to do a task, time is not wasted in copying the task again, such as copying a diagram, since in the workbook they are already drawn.
- Learners take the books home and this makes it possible for parents to help with their mathematics
- Because learners take the books home, they have time to read through their work and when their teachers ask them questions, they easily remember what they read
- Writing in the workbooks excites the learners and motivates them to keep doing more mathematics; this helps them to know mathematics
- The workbooks help learners to know mathematics because they are exposed to counting and writing numbers in 5s, 6s, 10s, 20s, and 30s.
- The workbook helps them to know a wide range of mathematics as they can do division, multiplication, subtraction and addition on one page
- There are illustrations and stories which require learners to figure out how many each one will have, so each learner is encouraged to think and write the answers according to the way they understand the question
- The workbook familiarises learners with larger numbers than the usual small numbers in textbooks.
- Workbooks do not repeat the same thing over-and-over-again; learners always encounter new challenging problems.
- Workbooks has types of problems that learners never met in textbooks.
- Workbooks enable learners to learn more things that are new.
- Improves learners' mathematical skills, learners learn to do better calculations
- Can write in the workbook and the teacher can also mark within it.
- A workbook is both a textbook and a notebook.
- There are tracing activities in the workbooks where learners are asked to trace through shapes such as circle, so they enjoy tracing in the workbooks
- When doing mathematics to do with shapes, learners like that they just have to write the numbers as the shapes are already drawn.

- The workbooks give learners an opportunity to master English.
- The workbooks do not require learners to spend anything since they are just provided.
- Workbooks do not require an accompanying notebook, but just a pencil. As such learners just have to worry about buying notebooks for the other subjects.
- Workbooks are pre-printed, and just require indicating solutions.
- Standard 1 learners cannot write, hence it is easier for them just to fill in the workbook.

Appendix E: List of all benefits of workbooks mentioned by teachers

- Every learner has his or her own book and when it comes to solve problems every learner is able to write in their own book
- Less work for the teacher to write on the chalkboard.
- No time wasted on learners copying from chalkboard.
- Each learner is able to use the workbook on their own rather than the previous curriculum
- The learners also have time to do their work on their own and to practise the questions at home
- Using learner workbooks helps learners to be active when they are learning
- Workbook provides enthusiasm to learners
- English language is creating a foundation of understanding English for the upper classes it also provides interest with mathematics to both learners and teachers
- Workbook acts as a learners' portfolio, making follow-ups easy for parents, guardians, government officials and even teachers. Learners who are not doing well can easily be traced
- It has reduced some costs to the parents of buying exercise books.
- Helps a learner to take care of his/her properties /ownership.
- It is easy to teach mathematics using workbooks because it directs the teachers on the activities to be done and it is easy to prepare teacher-led activities than to use textbooks
- Each learner has a workbook, and marking has been made simple because teachers mark at the very place where the question is compared to previous textbooks where teachers could write the questions on board.
- Learners feel comfortable when they work independently with workbooks.
- Learners are able to write in their workbooks each and every day without problem
- Marking is easy with workbooks, and more work is being covered.
- Learners know that each page makes for the day's lessons. This helps them prepare thoroughly before the day.

- The work is the same, so the teacher and the learners will do the same work, and it is easy to assist the learners.
- The NNP workbook is easier to use than the textbooks since it helps you think actively when preparing teacher-led activities thereby reducing laziness among teachers.
- Learners learn English as they do mathematics
- It is easy for the learners to follow what they are taught. Learners practise the tasks on their own free time because they have the workbooks
- It is easy for the learners to write the exercise because they do not struggle to write because many things are already in the workbook
- Workbooks are friendly to the learners
- Every learner has opportunity to use the workbook freely without disturbances from friends

Appendix F: List of all concerns of workbooks mentioned by learners

- Some illustrations, such as those of people's heads tend to confuse learners as sometimes they count them twice and end up getting wrong answers
- Some patterns are difficult.
- Workbooks mix addition and subtraction problems rather than having addition, subtraction, multiplication, and division problems presented separately.
- The way some shapes are drawn in the workbook does not match with the scale used by learners; for instance, learners' measurements can be larger than the shape indicated in the workbook.
- Workbooks do not indicate that the problem involves addition or subtraction.
- The number chains have too many calculations to be worked out unlike in the text books where there were only two or three numbers to be manipulated in a problem.
- Workbook problems are difficult and become easy only when used to them.
- Sometimes there are not enough workbooks for whole class and some learners have no workbooks until two weeks later.
- Sometimes the workbook pages are not legible enough.
- Workbooks can be lost after filling a large part of it.
- Because the books are in English, it's a challenge for those who do not know how to read and understand English.
- Some learners who cannot read often fail.
- It is difficult to follow along with the lesson when the workbook is forgotten at home.
- The ways of working in the workbook are difficult for those who have just joined the class, who are not yet used to workbooks.
- Some individuals fill the workbook spaces with useless drawings, and when the time comes to use the space such ones can't participate in the lesson.

Appendix G: List of all concerns of workbooks mentioned by teachers

- The manipulating part has too much work on the page to be completed daily.
- Starting with mental arithmetic is not easy, the mental sums are just too much.
- on counting most of the learners are not familiar with large numbers so learners find it difficult to write new numbers
- The shapes do not match with the ones on the drawings
- The arrangement of pictures in the books on counting confuse learners when they want to count.
- Some pages have too much work for the learners to cover within two periods especially the number operations and relations pages so learners feel bored.
- Mental arithmetic is not easy to form
- The arrangement of lesson on space and shapes and measurements are not good
- The work for the learners is too difficult to the levels of learners
- Methods of solving e.g. adding, subtracting, multiplying and dividing are too tough and many learners are failing to solve the problems.
- Too many concepts on a page which makes learners not to master the concepts quickly
- More training should also be there so that they should be reminded often.
- It promotes laziness among teachers since the work is stated as everyday work to be covered
- It is difficult for learners to take care of the workbooks