

Marking pupils' written exercises in mathematics: What are the benefits?

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The study investigated the various types of marking exercised by teachers and the accompanying written comments teachers make about pupils' written mathematics tasks. The sample of the subjects of the study consisted of twenty randomly selected teachers from the urban schools of Gweru and Masvingo. The marking of exercise books belonging to any one of the classes taught by each of the participating teachers was scrutinised. Informal interviews with teachers were conducted in order to get them to shed light on their marking and comments. Pupils whose exercise books were scrutinised also participated in the study. Informal interviews with some of the pupils were conducted in order to establish the benefits they derived from the marking and accompanying comments. The majority of the teachers who participated in the study practiced penultimate marking as opposed to stage by stage marking. Many teachers did not accompany their marking with written comments. Students found stage by stage marking beneficial to them.

Background

In Zimbabwe, the Ministry of Education and Culture recommends that teachers should pay attention and attend to individual needs of their pupils. Communicating to each individual learner is a fundamental and integral part of the teaching and learning process in any typical classroom situation. However the current situation in schools in Zimbabwe is that with a teacher-pupil ratio ranging from 1: 40 to 1:60, it is virtually impossible to achieve this during lesson time. The Nziramasanga Commission (1999) recommended a teacher-pupil ratio of 1 to 35 at secondary school level, but this is a far cry from the current situation on the ground. At independence in 1980, there were 177 secondary schools in Zimbabwe. This number grew to 1502 in 1989, an increase of 749% (Riddel and Nyagura: 1991). During the same period enrolment at secondary school level rose from 66 215 to 695 612 (Nziramasanga 1999). One of the effects of this sudden phenomenal expansion in the education system has been in the resultant untenable level of teacher-pupil ratios which are still prevalent in many schools in the country. Thus one of the viable alternative ways to engage in communication with individual pupils is through the written feedback given by teachers when they mark their pupils' written work. It is interesting to note that in Finland, Sorvari and Pehkonen (2001) noted a similar problem of big classes and the resultant reduction in the time allotted to help pupils individually and suggested a different solution. They recommended that different ways of group working which would support effectively the development of pupils' mathematical thinking should be developed. The study investigated the various types of the teachers' written feedback to their pupils

which result from the marking of pupils' written mathematics exercises and tests.

Significance of the study

It is not always possible for all pupils in a class to actively participate during the oral sessions of mathematics lessons. On the other hand, written exercises conducted during lesson time or after lesson time always afford a chance for active individual participation to every pupil to practise and learn mathematics. This usually results in a lot of time being used in marking pupils' written work. Thus marking should be a fundamental and integral part of the teaching and learning process of mathematics and hence care must be taken to ensure that this exercise is both meaningful and fruitful to both the teachers and their pupils. If marking is thoroughly and regularly done, the teacher can use it to communicate information which would assist the learners to achieve the desired set goals. It can for instance tell the students what they have done wrong, where they have gone wrong, what they need to do in order to remediate the situation, references to source for further information and so on.

Research questions

The study attempted to answer the following research questions:

- 1 How do teachers mark pupils' written work in mathematics?
- 2 What types of messages are communicated to pupils by teachers, when they mark pupils' written work in mathematics?
- 3 What benefits are derived by pupils from teachers' written comments about their written work in mathematics?

Literature review

The Ministry of Education and Culture directs that pupils' written work should be marked regularly and progress records in the form of marks be kept in a formal record book. The written work can be in the form of classwork which is done during lesson time, homework which is done after school time usually at home, assignments, tests, project-work and internal examinations (Ministry of Education: 1995). There are several types of marking which a teacher could use to score pupils' written work in mathematics. They include the following, objective marking of multiple choice answers, objective marking of structured solutions, subjective marking unstructured solutions, subjective follow through marking of pupils' logical thought and subjective impression marking on creative work and drawings (Ashworth: 1981, Cooney: 1975, Gronlund: 1981, Satterly:1989, Simmons: 1993).

A marker should look out for both quantitative information and qualitative information. Quantitative information can be scored objectively and shows the level of performance of the pupil while qualitative information cannot be scored objectively and looks at the reasoning behind a pupil's solution. For objective

scoring, the human factor does not influence marking but in the case of open questions this is not feasible (De Lange 1987 and Streefland 1991). Thus specific type of marking may depend on the nature of written exercise to be scored.

Methodology

The researchers worked with a randomly selected sample of twenty secondary school mathematics teachers, in two cities in Zimbabwe. Ten of the teachers from each of the two cities participated in the study. The marking of all mathematics exercises written by one of the classes taught by each of the participating teachers was scrutinised. Only the exercise books which were used during the first school term of the year 2001 that is, from January 2001 up to April 2001 were reviewed. The types of symbols used and comments written by the teachers in marking were noted. The manner and frequency of marking were also noted.

Informal interviews were conducted with some of the pupils whose exercise books were reviewed and their respective teachers. The interview questions were based on the issues of interest, which were noted during the reviewing of the marking of pupils' written work. The purpose of the interviews was to find out if pupils benefited from the feedback their teachers communicated to them through marking. The interviews were also meant to establish if pupils understood the messages which their teachers conveyed to them, through the symbols and comments used by the teachers in marking. The marking reviews and interviews also investigated whether or not teachers followed up on the advice and instructions they gave to pupils to find out if these had been taken up.

Results

Both qualitative data and quantitative data were recorded and analysed. Data on the teachers' manner and frequency of marking were classified into the four categories shown in Table 1. It was noted that some teachers always marked at the penultimate stage only, others always marked at all the key stages of solutions and the rest mixed the two types of marking to varying degrees of proportion. The study established that some teachers always accompanied their marking with comments, while others never made any comments while still others sometimes did it and at other times did not.

	Penultimate stage marking without comments	Penultimate stage marking with comments	Step by step marking without comments	Step by step marking with comments
1. A	61%	14%	23%	2%
2. B	73%	15%	12%	0%

3. C	66%	6%	19%	9%
4. D	91%	9%	0%	0%
5. E	59%	26%	12%	3%
6. F	32%	13%	38%	17%
7. G	85%	4%	10%	1%
8. H	79%	21%	0%	0%
9. I	74%	17%	9%	0%
10. J	64%	17%	10%	9%
11. K	76%	11%	5%	8%
12. L	50%	19%	24%	7%
13. M	59%	26%	9%	6%
14. N	47%	31%	16%	6%
15. O	67%	8%	23%	2%
16. P	73%	18%	9%	0%
17. Q	38%	21%	14%	27%
18. R	51%	30%	14%	5%
19. S	90%	10%	0%	0%
20. T	67%	7%	26%	0%

Table 1

The data in table 1 showed that the marking of 13 out of 20 teachers fitted into all the four categories but with varying degrees of proportion. The amount of work marked at the final stage with no accompanying comments by 19 of the teachers, was in each case more than for all the other categories. For 17 out of 20 teachers the amount of work marked at the penultimate stage with no accompanying comments, ranged from 50% upwards. Thus the results above showed that 85% of the participating teachers were mostly interested only in the final answer and thus they put either a tick or a cross only at the final answer stage and did not comment on the work. They generally disregarded the intervening pupils' working as if it were of no consequence to the teaching and learning process. In this type of marking, teachers did not indicate to the pupils where they went wrong, why they went wrong, how they could correct the situation and so on. The consequence of such type of marking, was that there was a possibility that pupils could have repeated the same mistake and come up with the same answer again, when they wrote their corrections. Such a scenario could on its own, be a frustrating experience to the learners. There was also the possibility that pupils would not know where to focus their attention and efforts on, when they did the corrections for the marked work.

During informal interviews, some of the participating teachers indicated that an interested learner need only be told that he/she had made a mistake. Thereafter the task of finding out where the mistake was, how it could be corrected would be entirely up to the learner. However the review of marked

exercise books revealed that in practice, when it came to doing corrections, some of the pupils simply copied correct work from their colleagues.

The reviewing of pupils' exercise books also revealed that teachers sometimes assigned pupils to either mark their own books or to exchange their exercise books and then mark each other's work. It was established that some teachers endorsed the marking done by pupils and that others did not. The teacher's endorsement of pupils' marking was classified into two categories. The first category was when the teachers made one big tick at the end of the marked exercise, or repeated pupils' ticks and crosses without any deviations and moderation of pupils' marking. The researchers termed this, superficial endorsement. The second category of endorsement was when teachers went over the pupils' marking thoroughly, and made several amendments. Thus there were instances where the teachers either agreed or disagreed with the pupils' marking. The researchers termed this, detailed endorsement. The data which were collected on this manner of marking pupils' work, were as shown in Table 2 below.

	Superficial or no endorsement of pupils' marking	Detailed endorsement of pupils' marking
1. A	74%	26%
2. B	63%	37%
3. C	100%	0%
4. D	81%	19%
5. E	100%	0%
6. F	65%	35%
7. G	91%	9%
8. H	89%	11%
9. I	66%	34%
10. J	73%	27%
11. K	85%	15%
12. L	71%	29%
13. M	42%	58%
14. N	61%	39%
15. O	53%	47%
16. P	96%	4%
17. Q	67%	33%
18. R	89%	11%
19. S	79%	21%
20. T	77%	23%

Table 2

The results above showed that there was only one teacher out of twenty who thoroughly checked more than 50% of the pupils' marking. For the remaining 19 of the participating teachers, the amount of pupils' marking which was superficially endorsed, ranged from 53% upwards. Two of the teachers did not carry out any detailed endorsement of the pupils' marking, at all. The other 18 teachers did some detailed endorsement in varying degrees of proportion which were all smaller than those for superficial endorsement. The implications of this behaviour on the part of the teachers is that there could many errors which were passed on as correct information and which pupils could have studied as part of their revision to consolidate the lesson content. It could also have meant that no meaningful communication was made to the learners to inform them how well they had done their work, where they had gone wrong and what they needed to do in order to make progress towards the desired set goals. Informal interviews with some of the participating teachers revealed that some teachers randomly checked some of the work which pupils had marked for themselves. They hoped that doing so ensured that pupils would not cheat since they would not know whose books would be checked and when they would be checked. Thus not all written work which was marked by pupils was checked on a regular basis by the teacher. The major reason for asking pupils to mark their own work, was noted to be failure for various reasons by teachers to mark the work before the succeeding lesson.

Qualitative data regarding the teachers' comments were classified into the following four categories: positive, negative, instructional and content-related comments. Examples of some of the comments are shown in Table 3 below.

Positive comments	Excellent work, Very good, Keep it up, Well done, Good, Fair, Fairly good, Very neat work, Accurate diagrams/drawings.
Negative comments	Untidy, Very poor, Poor, Not true, Wrong, Stupid, Idiot, Do not cheat, You copied from someone, Wrong method, Incomplete work.
Instructional comments	Number your work, Insert equal signs, Write clearly, Show all working, Label your diagrams, Complete your work, See me, Do your corrections before starting on new work.
Content-related comments	Revise your work, Incorrect statement, Misconception, You did not understand this work, Premature approximation, Incorrect sequence of operations, Incorrect labelling.

Table 3

By and large the majority of comments written by teachers fell into the positive, instructional and content-related categories. There were very few cases of negative, rude and discouraging comments written about pupils' work by some teachers, it was important to note that these could have far reaching effects which are detrimental to the concerned pupils' progress in the learning of mathematics. For many teachers, there was no evidence in pupils' exercise

books that they followed up on their written comments. For example, it was observed that the work which had been indicated by the teachers as being incomplete, was ever eventually completed. Follow up interviews with some of the teachers revealed that very few teachers investigated why the work was not completed in the first place and thereafter. This of course could give rise to some fundamental pedagogical questions being asked. It would be pedagogically prudent to establish the reason why pupils failed to complete assigned written work. For example, was it because the pupil did not understand the work, was the pupil merely lazy, was it lack of time to do the work, and so on? A similar observation was also made about the comment; “Do your corrections”. There again was no evidence in the pupils’ exercise books that such corrections were eventually done. There were also no indications as to what steps the teachers took, after realising that their instructions had not been followed.

Informal interviews with some of the pupils whose work was used in the research revealed that pupils were encouraged by positive comments and that they got some meaningful guidance from layout and content-related comments. However negative comments tended to make them dislike mathematics and made them feel that they were hopeless.

Teachers used a wide variety of symbols in marking their pupils’ work. The most prevalent of which were found to be ticks to indicate the correct aspects, crosses to show the incorrect sections, omission signs to point out that something had been left out, underlining to indicate incorrect sections, encircling to show the incorrect parts, question marks to show work which was not expressed clearly and punctuation marks to help clarify expressions. Pupils claimed that marking at the answer stage only, was not very helpful to them when they attempted to do the corrections. They also felt that the excessive use of crosses was both annoying and discouraging, while on the other hand liberal use of the ticks had a motivating effect. Many pupils claimed that they did not always understand the messages some symbols such as question marks on their own were meant to convey.

Conclusion

By making sure that pupils’ work was marked regularly albeit by themselves or by assigning the task to their pupils, teachers met the minimum requirement of the demands of the Ministry of Education and Culture, concerning pupils’ written work. However the quality of marking differed from one teacher to another. The researchers identified two extreme types of the marking done by teachers. These were the stage by stage marking accompanied by written comments and the penultimate-stage marking without accompanying written comment. The majority of teachers practised penultimate marking as opposed to stage by stage marking. The penultimate stage marking seemed okay if everything was correct but not very informative when something was incorrect.

In contrast, stage by stage marking showed the mistake and where it was made. In addition to being only interested in the final answer stage, the majority of teachers seldom accompanied their marking with written comments to guide or encourage their students. There were some teachers although in the minority who wrote negative comments about their pupils' work. Teachers generally did not follow up on their written advice and instructions to pupils in order to try enforce them.

Pupils indicated that they found step by step marking helpful and positive comments by their teachers encouraging. It was established that pupils felt that instructional and content-related comments gave them guidance on what was needed to be done and how it could be done. Pupils disliked negative comments and found them to be discouraging. The researchers therefore recommended that marking should be done stage by stage and meaningful accompanying comments should be made to guide pupils in the desired directions, encourage pupils to try harder or to give credit for work done well. The researchers felt that it was better to give small amounts of work which teachers were able to mark thoroughly rather than give excessive amounts of exercises whose marking they could not cope with. Such action may help in ensuring that thorough and regular marking is done by the teacher. The practice of making pupils mark their own work should be discouraged. The practice was found to be time wasting, since for it to be meaningful and effective, the teacher still had to thoroughly go over the marking again.

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