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'Can Classroom Talk Support Student-Centred Teaching?' - a Study of Maltese Physics Classrooms

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Abstract

'Classroom talk' refers mostly to the verbal interactions that result between teachers and students in the classroom as these engage in teaching and learning processes. These interactions are meant to support students' learning about scientific concepts. In this study, the kind of classroom talk occurring between Maltese teachers and students during physics lessons was investigated.
The concept of the 'communicative approach' developed by Mortimer and Scott (2003) was employed to provide insights on how Maltese teachers work with students to develop ideas throughout the science lesson. There are 4 classes of the communicative approach, defined by the teacher-student talk along 2 dimensions: the interactive-non-interactive dimension and the dialogic-authoritative dimension.
The first dimension takes into account the level of teacher-student interaction during a lesson while the second dimension considers whether teachers make use of students' ideas, even when these were not based on scientific facts. This research asks two questions: [i] 'To what extend does the Maltese teacher interact with the students during the physics lesson?' and [ii] 'Are all students' ideas taken into account as the lesson proceeds?'. Furthermore, factors that effect classroom discourse like wait-time [Rowe, 1987] and IRF patterns [Sinclair and Coulthard, 1975] were also explored in order to obtain a more complete picture of classroom talk as this develops in the physics lesson.
In this study we made use of a mixed methods approach. Fourteen physics lessons presented by fourteen different teachers were recorded and observed. The participant classes ranged from Form 3 to Form 5. The one hundred eighty eight students who were observed in the lessons then provided feedback to a questionnaire. The fourteen teachers who conducted the lessons also took part in a one–to–one interview. These methods allowed for triangulation of the data generated from the different sources.
The findings of this research indicated that this sample of Maltese teachers mainly initiated talk through questions which only required one- or two-word answers. Also, teachers used authoritative/interactive and authoritative/non-interactive discourse as their main communicative approach. On the other hand, dialogic discourse was scarcely used by Maltese physics teachers. Lastly, the estimated wait time used these teachers was found to be around 1.7 seconds. This short time interval does tend to have negative effects on student participation during lessons.

1. Introduction

In the "Trends in International Mathematics and Science Survey" (TIMSS), Malta has participated for the first time in 2007 with Form 3 students and ranked 30th in science achievement amongst 49 participating countries. The survey has also showed that 52% of the Maltese students are at or below the low benchmark [5]. This data is cause for concern and it could be that one of the underpinning causes of students' low achievement in science might be linked to classroom talk. In fact, there is evidence from various studies that withdrawal from science is related to the dominant discourse practices taking place in science classrooms [8].

1.1 Patterns of classroom talk

As a subject of study, classroom talk started to be investigated around the mid-1900s. Studies report that the most common type of talk that took place in the classrooms had an "underlying structure" where "a teacher asks a question, one or two students answer, the teacher comments on the students' answers (sometimes summarising what has been said), and then asks a further question." [11]. This dominant pattern of talk was commonly referred to as Initiation-Response-Evaluation [IRE] [9,2] or 'triadic dialogue' [8] has provided discourse that is "dominated by a teacher-led structure that focuses on the 'facts'" [4].

1.2 Wait time

Another issue leading to low achieving students becoming passive participants might be that they are not given enough time to think when asked a question. In classrooms teachers tend to ask a number of questions in quick succession but with all these questions and with the teacher herself expecting quick answers, students are left with very little time to think. In the response phase, the wait time that a teacher waits for a students' answer can prove to be problematic. It has been found that "pauses of at least 3-5 seconds after questions allow time for students' reflection and appears to increase the number of student responses, enhance student confidence in his or her ability to answer, and promote longer, more accurate student answers." [3]. However, increasing the wait time is easier said than done as many teachers find it difficult to get a wait time up to three seconds or more [12].

1.3 Classes of the communicative approach

Various teachers ask questions "not so much to provoke student thought and analysis, but to transmit a specific, common understanding to students, and/or evaluate whether students hold the common understanding." [7]. Thus various teachers are only interested in getting the correct response from students and this response normally has to do with scientific facts. Teachers mainly do this by asking close-ended questions requiring one specific answer [1].

Another research study [10], considered the teachers' feedback to the students' responses and hence examined the evaluation part of the IRE pattern. They worked on and proposed a different approach to classroom discourse and questioning in a science classroom. In their proposal, they stated that there are two categories of communicative approach. These consist of: [i] the Interactive-Non-interactive category and [ii] the Authoritative-Dialogic category. The former takes into consideration whether students participate or not during classroom discourse while the latter takes into account the extent to which the teacher hears, gathers and accepts students' answers regardless of whether they are scientifically correct or not. Taking these categories into account, teachers' talk can be classified into the four classes of the communicative approach:

[i] Authoritative/Non-interactive (A/NI) – The teacher is constantly giving his/her ideas, facts and opinions not allowing students to participate.

[ii] Authoritative/Interactive (A/I) – The teacher allows for students' participation, however, his/her sole focus is a scientific idea and if students do not come up with this, their suggestions are put to one side.

[iii] Dialogic/Interactive (D/I) The teacher listens to and takes into account all of the students' views even when this is different from the scientific view.

[iv] Dialogic/Non-Interactive (D/NI). The teacher listens to students' ideas but does not interact by allowing turn-taking interactions with students.

2.0 Research strategy

The research strategy used in this study was a mixed methods data generation exercise. This exercise was meant to provide some insights about the type of classroom discourse used during physics lessons in Malta. The strategy made use of three different research methods:

- Audio recordings and observations of 14 physics lessons. The duration of these lessons ranged approximately from 45 to 90 minutes.
- One-to-one interviews with the 14 participating physics teachers.
- A total of 188 questionnaires distributed to the participating students.

The research was done in schools across Malta and details about the number of students and teachers participating in the study are given in Tables 1 and 2 respectively.

School Type	Male students	Female students	Total number of respondents
Church	32	0	32
State	56	89	145
Independent	8	3	11
Total	96	92	188

Table 1: *Number of student participants by school type and gender.*

School Type	Male teachers	Female teachers	Total number of participants
Church	1	1	2
State	4	7	11
Independent	1	0	1
Total	6	8	14

Table 2: *Number of teacher participants by school type and gender*.

A total of fourteen lessons were observed and audio recorded. Classes ranged from Form 3 to Form 5 students (age range was between 13-16 years old) and were chosen according to the availability of the participating schools.

3.0 Results and discussion

The results of this research focus on an examination of the IRE patterns that develop during classroom questioning. Furthermore, the 'wait time' that teachers' make use of during the response phase is studied and its effect on learning discussed. This study concludes with an investigation into the type of communicative approach that Maltese teachers adopt in their lessons.

3.1 The initiation phase – questioning as the starting point of understanding

The data generated from this study shows that the initiation phase of the I-R-E pattern of interaction is dominated by teacher questioning. All fourteen Maltese physics teachers who were interviewed in this study stated that they used questioning as they were interested in students' common sense ideas that are not necessarily based on science. They believe that this makes it easier for them to explain their point of view and it supports students' understanding of scientific concepts.

The students' feedback from the questionnaire contrasts with that shared by the teachers as 67% of the 188 participants stated that teachers give their own ideas and explanation when introducing new ideas. Hence, according to students, it seems that teachers make very little use of students' prior knowledge. The researchers' observations support this finding as this sample of teachers asked mostly close-ended questions and guided talk so that they would elicit only particular answers from their students.

3.2 The response phase – the opportunity for students to participate

In this study, during the interviews, teachers stated that they are concerned about time constraints as they have a demanding syllabus that needs to be covered in time for examinations. This limits the possibility of allowing students to share their ideas about science. Even though 87% of the students' cohort stated that they are given enough time to think, the observations and audio recordings showed otherwise. From the audio recordings, it was determined that the teachers wait an average of 1.7 seconds for student feedback.

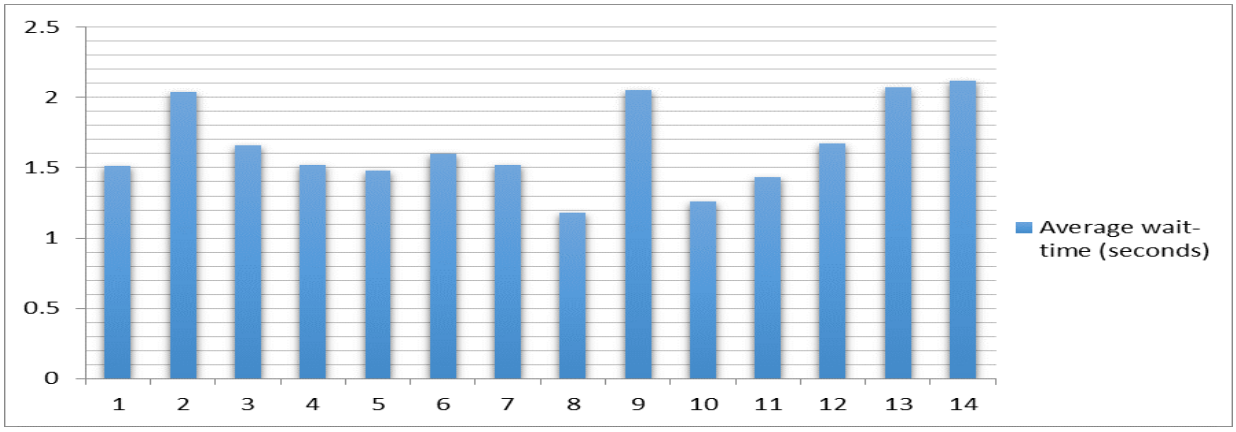

Fig 1: *Average wait time calculated for every lesson.*

This is in the region of the wait time calculated by [12] and also [6] where they estimated an average wait time of 1 second and 3 seconds respectively. Students might think that they are given enough time for their feedback because the answer required from them is just a one- or two-word answer which tends to be recall.

3.3 The evaluation phase – evaluation or feedback?

In science there is the risk of believing that "the science teacher is seen as the elder who 'knows all' in matters relating to scientific facts, processes, principles, and laws" [6]. Teacher talk in the evaluation phase of the I-R-E pattern becomes important to consider as it is during this phase that students' contributions, even when not based on science, are being taken into account or put aside by the teacher. The main finding obtained from the student questionnaires and classroom observations regarding this phase is that, at the end, the teacher still gives his/her own answer mainly because of the time restrictions already mentioned.

3.4 Maltese physics teachers and the communicative approach

An analysis of the audio recordings indicates that Maltese physics teachers tend to be authoritative for most of the time during the lesson (around 86%). This time is approximately equivalent to 41 minutes from a 48-minute lesson. In this time, teachers spend around 23 minutes using the authoriative/interactive mode and 18 minutes in the authoriative/non-interactive mode. On the other hand, the least common type of talk used by Maltese teachers in schools is dialogic talk as this is less than 1% of lesson time. The 'other discourse' refers to talk about everyday issues that are not related to the subject matter.

This data provides an indication that these physics teachers tend to focus on students' answers that only have to do with scientific facts. If teachers only seek particular answers from the students, then they would not wait for students to give their own ideas or use these during the lesson. The low calculated wait time of approximately 1.7 seconds found in this study supports this finding.

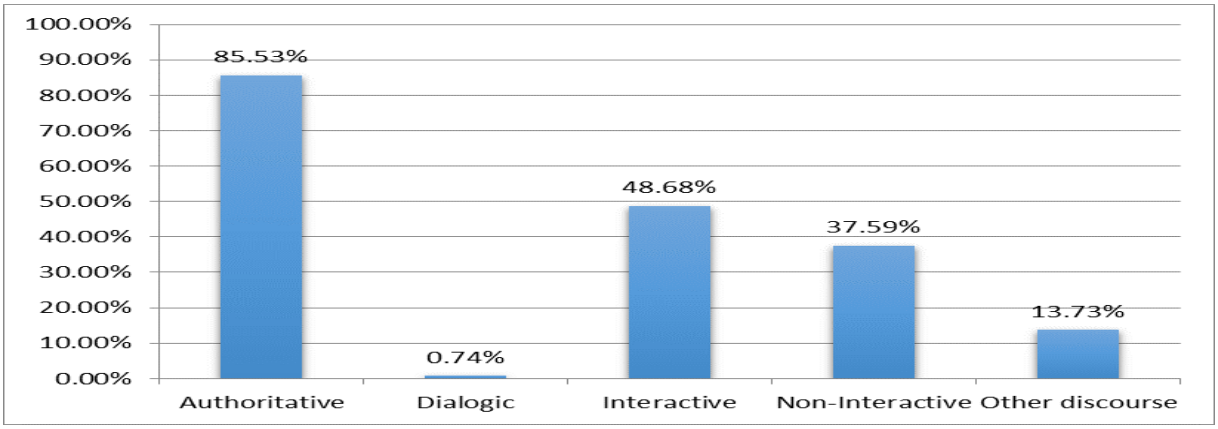

Fig 2: *The percentage time during which different communicative approaches were used by Maltese teachers.*

4.0 Implications for teaching and learning

The fact that teachers interact with their students through the use of the I-R-E pattern might give the illusion that they are dialogic. Teachers might think that by asking a lot of questions during a lesson they are doing good practice. This is not always the case and teachers need to constantly reflect on how they can make their questioning strategy more effective. In this respect they need to go through a process of unlearning and try to work at a mode of teaching and learning that can support them in improving their students' understanding.

In-service courses can make teachers more aware of the usefulness of dialogic discourse but to change to such classroom practice requires a hands-on approach and an attitude of strong perseverance. Furthermore, the teachers need to be accompanied by Education officers, Heads of departments, other trained personnel and peers in this process so that concerns that teachers raise regarding time management and syllabus constraints do not hinder them from improving the quality of their classroom discourse. While being aware that a tension exists between the time management

issues and the shift to dialogic classroom talk one needs to persists in doing this as it is one way that can render our teaching really 'child centred'.

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