Mathematics for All. A critical Approach.

Seminar held on 6th February 2015

Insights from Panel 1

- Transmission approach still prevalent
- Teacher autonomy on content
- Pedagogy/methodology has not changed
- Change of system / structure to entire teachers to teach differently
- Focus on mathematical process for a good basis
- Certification invoice: Paper C in December on School Leaving Certificate
- Process and content go together and can be split
- Abstract, concepts are important; focus can’t be only on real-life situations.
- 30% of students finding difficulties – low, socio-economic background students need more time in a lesson to explore concepts well.
- Can literacy challenges be a stumbling block to some students?
- Need for empirical research - who are the 30% of those students failing exam. Are they the same as those failing other subjects. There are also those not sitting for exam.
- Modular approach in Maths?
- Can textbook used be adding to the challenges?
- Primary context – some concepts are introduced too early in School, other concepts are absent and sorely needed for Secondary Schools.
- Specialist teachers in Maths based in each Primary School.

Insights from Panel 2

- Problem solving situations introduced in Maths lessons for the low-achievers.
- Use of IBL in Maths pedagogy.
- Time is an issue – is it because of content or pedagogy?
- Class numbers in Primary classes.
Secondary marks – 6, 7 are not valuable to students.

Core Curriculum Programme must be a step to take students further but then recognised in a valuable mark which can give access to further education and/or employment.

Parents need to be involved in order to give support.

Online tools and games must be used by teachers to entice students to Maths and increase their interest/passion for the subject.

Teachers must start themselves to bring about change, and not wait for the system to change for them.

A social stratum of students who do not care about Maths and are very problematic in the classroom.

Diagnostic tests – where are these leading to?

Challenging activities to push higher achievers further.

Zilberger – Israelite Mathematician based in US, proposes Maths not compulsory in Schools.

Make maths fun. This may not necessarily be functional always.

Time is always an issue.

For whom Maths is important? We must consider the whole cohort of students.

We need to consider the realities of the classroom.

**Insights from Workshops**

**Workshop 1 – Core Mathematics**

**Is there a place for Core Mathematics?**

Some participants did not see the need for a new subject ‘Core Mathematics’ as the current assessment at the end of compulsory schooling could be adjusted to cater for students with a wider range of abilities. This could be achieved by widening the range of grades that students can achieve when sitting for the current SEC Paper A and Paper B.

To date SEC Grades 6 and 7 have little value since students cannot present these grades to further their studies at post-secondary level, except for a few courses at MCAST. It was argued that grades 6 and 7 in Mathematics could be accepted as an entry requirement to post-secondary courses that are not related to Mathematics.
However, some participants argued that the current structure of the Mathematics SEC exam needs reviewing. The Mental Paper is a test against time for a number of students. Paper 1 also proves to be a stumbling block for a number of students especially those sitting for Paper B. The order in which the papers are set should be altered.

It was also noted that failures in mathematics compare well with other subjects like English and Maltese. Thus it may not be the case that Mathematics is the only stumbling block that keeps students from furthering their studies. These students find difficulties in other subjects as well as Mathematics.

**What should it consist of and for whom should it be targeted?**

Core Mathematics should focus on strengthening skills and processes. It should be broad in nature, i.e. including all strands of Mathematics. It should not be limited to serving the requirements of particular career options. Also, Core Mathematics should not take over the function of the current Core Curriculum Programme (CCP). Continuous assessment should be adopted in such a course of studies.

It was suggested that the industry sector should be consulted when developing the subject so as to identify the needs of industry today.

Core Mathematics should be targeted for students:

- who are struggling with the current syllabi
- who intend to seek employment at 16+
- who do not intend to further their studies in the subject or in related careers.

No consensus was reached on the stage when Core Mathematics should be introduced. Some suggested Form 1 while others proposed Form 3, since the Form 1 and Form 2 content is already basic in nature.

**How should it compare with “Mathematics” and other subjects?**

Core Mathematics should have the same equivalence as the current mathematics. Core Mathematics could be set as an entry requirement to courses that do not require an in-depth knowledge of mathematics. Students furthering their studies in mathematics and related areas should still be required to be in possession of certification in mathematics as we know it today.

**What are the implications of introducing Core Mathematics?**

There is the concern that parents and people at large might consider Core Mathematics as an inferior form of Mathematics. Should Core Mathematics be introduced, how are we going to ensure that it has the recognition from foreign universities/entities? Which certifying body can give this assurance?
Workshop 2 – Mathematics in the Primary School

Would subject teaching in Junior Years alleviate the issue of teachers not specialised in mathematics? Will this further address the lack of qualified teachers at Primary?

Having a teacher specialised in the subject s/he likes could encourage teaching and learning which transmits the love for mathematics. Generalist primary teachers who do not like mathematics but have to teach it may transmit a fear (which they themselves may have) to the kids. However, it was recommended by all the members in the workshop that subject teaching should not happen in early years, but preferably in junior years.

A concern which was put forward by some teachers in the workshop was that the primary specialised teacher may be limited by a set time for every lesson. On the other hand, this was seen as an advantage by some other teachers because this limited time would possibly imply better lesson planning and would avoid unnecessary lengthy maths lessons.

A further query was put forward: On what grounds are the specialised primary maths teachers to be chosen, should specialised teaching be adopted at primary level? Are the teachers to be really specialised in mathematics, or simply general primary teachers who are passionate about mathematics who take this role on a first-come-first-served basis?

Moreover, some teachers in this workshop expressed their concern as to whether specialised teaching at primary level could hinder cross-curricular teaching. However, other teachers insisted that despite having specialised teaching, teachers of different subjects could still liaise with each other and join forces. Additionally, a maths lesson can still address cross-curricular aims.

Another suggestion which was put forward is to have teachers with an extra role as coordinator for particular subject i.e. there will be general primary class teachers but they will be supported by the school maths coordinator (who will also be a general teacher herself/himself).

Finally, all teachers in this workshop insisted that teachers’ up-skilling should be a priority whether we adopt subject teaching or not.

Are the current assessment procedures valid and fair to all students?

Children learn in different ways, thus since we are mainly assessing through pen and paper procedures, we cannot say that our current assessment procedures are fair to all students. Some children may also encounter difficulties because of language barriers. Continuous assessment should be adopted and it should be given a percentage of a final annual mark. This continuous assessment should follow particular set criteria which should be translated in different tasks throughout the scholastic year. These tasks could vary from problem-solving situations and investigations to Maths Trails and hands-on mathematics
tasks. Besides being more fair, this could also enhance the teaching and learning of mathematics and further address the lack of hands-on experience in the classroom.

The idea of having an oral component as part of the final annual mark was also discussed. During this component the children could be given a problem-solving situation or an investigation to solve or a hands-on task to work on. This will be piloted shortly through the diagnostic tests designed by the Primary Mathematics Support Team.

A teacher from a non-state school said that, in her school, they have already adopted continuous assessment, where the annual grade is composed of continuous summative assessment and a final written paper.

Another teacher in the workshop asked whether the mental maths assessment could be more visual, considering that for example there could be kids with lower auditory skills.

**How shall we address the issue of under-achieving students who are already failing at this level?**

While it was agreed that a more hands-on approach and better use of resources will better address the needs of all students, the need for complementary teachers for mathematics was emphasised by all the teachers in the workshop.

**Workshop 3 – Assessment**

**Is the current SEC examination a valid measure of assessment?**

It was claimed that there is a good element of internal validity in the SEC Maths exam. However the exam itself has drawbacks; the fear induced in students may hinder them to get the grade they deserve. The system in the secondary, especially from Form 3 to 5 is geared towards the SEC and that this hinders teachers from doing activities like investigations.

The aim of the SEC is not to cater for all students but 80% of them.

Prof Ventura claimed that the results obtained by students in SEC are very similar to those obtained by Maltese students in international assessments. This means that SEC is on the same lines as international assessments and that the figures obtained in SEC seem to picture the situation for our students. He said that we might need to establish a way how to certify students who do not sit for SEC or who underachieve. This would mean a level 1 or 2 in MQF. Is it a good idea to have a paper C? But then to grade them with 8, 9 or 10 might not be appropriate. Should we have another exam, perhaps not called “SEC”, to be able to certify these students?

**Is it always fair to all students?**

Some career pathways are inaccessible because Maths is made as an entry requirement. Some participants argued that for certain careers, especially for certain Junior College choice
of subjects, maths may be taken off the list of requirements. We need to accept the fact that not all students perform at the same level. Having said that, all students need to have a basic mastery of the subject.

Students opting to further their study in maths at Junior College should be those students who have sat for paper A in their SEC exam as the syllabus for this paper covers more algebra topics which is then needed for their intermediate and A-level.

**Which other assessment procedures could be introduced to ensure a more valid summative assessment that is fair to all students?**

A teacher working at The Archbishop’s seminary said that their school prepares three papers with different levels of difficulty. All students sit for these three papers but at least low achievers may still work out a good portion from the easiest paper.

Many stressed the importance of not having one exam as the only base for assessment but multiple small-scale exams/tests throughout the year.

It emerged that grades for SEC results are worked out in a norm-referenced way, which means that the performance of a student is seen in relation to how fellow students have performed. Should we go for a criterion-referenced way of assessing? This would mean that a student gets a grade according to the items, concepts or skills s/he is able to demonstrate correctly during the exam. But the nature of items may play a crucial role in this.

**What are the implications of introducing continuous assessment?**

If continuous assessment is introduced, it has to be something standardised throughout all national secondary schools. Marking should have a set of criteria and standards. Moderation is also crucial in this. This would ensure reliability. Continuous assessment increases students’ motivation and efforts throughout the year.

Some claimed that we should remove half yearly exams and focus more on continuous assessment throughout the year.

Prof Ventura claimed that, it was possible for other SEC subjects to introduce continuous assessment. Likewise, it is also possible to implement it for SEC maths. Other claimed that continuous assessment should only be used for students and teachers to improve their learning and teaching methods. This should not have an influence on the final summative assessment. Continuous assessment in this sense could render the SEC unreliable.

**Who should be the awarding body for the certification at the end of compulsory education? The school, college, education department, university, foreign boards?**

Almost all participants agreed that certification should be from a body outside the school as schools may have different expectations from students. This could well be the education department or university.
Workshop 4 – Teacher Training and CPD

Is teacher training adequate?

- No course prepares ready-made teachers. It is classroom experience that is critical to the development of teaching.
- The B.Ed. and PGCE courses seem to be supporting teachers in being well prepared to plan lessons and keep up-to-date teaching resources. However, there seems to be some lack in preparing teachers’ classroom management. This seems to be a result of a lack of teacher models and modelling situations that may assist pre-service teachers in developing this ability.
- There is also the need for training courses to prepare teachers as critical learners – questioning and reflecting on theory and classroom practices. Also a collaborative learning culture needs to be cultivated and sustained both through the university course and in schools.
- It seems to be some missing link between the theory and practice ‘lectured’ by ‘experts’ at university.
- Should we speak of mathematics teachers or of mathematics educators – which role do we need to assume?
- Is the mathematical content covered at university relevant and necessary for pre-service teachers?
- It seems that the learning experiences of student teachers shape the way they view teachers, their role and teaching in general. Sitting in for lessons for almost 20 years, student teachers would already have framed a model of what a ‘good’ teacher could be. This tends to be usually represented by one who undertakes a transmission approach.
- Rather than having student teachers taking over a class once a week, it would be a better experience had these teachers had an experience of planning and delivering lessons with more experienced in-service teachers. The role of a mentor would probably provide a more supportive learning experience for student teachers.
- A re-thinking of the induction training provided to newly qualified teachers, although useful, still needs to be addressed.

Is there a need for continuous professional development of teachers?

- CPD is currently top-down. Somehow ‘experts’ seem to know what teachers working in different contexts need. It is a one-size-fits-all training.
- CPD should be bottom-up, i.e. initiated from teachers, related to issues of practice and addressing teachers’ needs.
- Present In-Set course seem irrelevant, ineffective and unproductive.
- In training teachers about, for example, mixed ability teaching, we need to present models of good practice to which teachers can relate to and learn from.
Workshop 5 – Pedagogy and Resources

Are prescribed syllabi a stumbling block to effective mathematics teaching and learning?

- There were various viewpoints regarding prescribed syllabi. The following points were mentioned:
  - Teachers from Independent and Church schools are more accustomed to syllabus flexibility.
  - Guidelines are important, but the syllabi should be less prescriptive.
  - There should be more autonomy at college level. This has a direct effect on annual exams which are the same for all.
  - Many topics are repeated every year, it would be better if they are covered more in depth and revisited and applied when necessary.
  - Some teachers mentioned that they prefer exact syllabi guidelines, for example: multiplication of integers up to two digit-numbers by two-digit numbers.
- Time is the biggest stumbling block. Teachers who currently have six maths lessons a week said that it is an advantage.
- Number of students in a class was an issue raised by church school teachers.

Are schools equipped with the necessary resources?

- It is important that teachers have their own classroom to make best use of the resources available. It is useless having resources stored in a cupboard which is not accessible. Besides, teachers cannot carry with them laptop, books and resources for three different consecutive lessons.
- Infrastructure is important. For example: it takes ages to plug/unplug laptop.
- Need of new laptops. Many complained of old, un-responding laptops!
- To know what resources are available, e.g. robotics. These resources could be brought to schools through the IT support teachers.
- Computer labs – RLOs could not be accessed through the students’ username/password.

Studies claim that text books are being used as the main tool for the implementation of the syllabus. Is this a limiting factor?

- There is no such thing as a perfect textbook.
- It is another resource.
- Reference was made to ‘tailor-made’ work books (hand-outs) prepared by teachers.

Are the pedagogies we are adopting capitalising the innovations in technology?

- Internet is a big resource.
- But are we making good use of the interactive whiteboard? Some teachers expressed their wish to learn how to make better use of this resource.
Are we addressing alternative ways of learning?

- It depends a lot on the teacher’s attitude.
- We assess in one method. This is a major stumbling block – an obsession with exams.
- Cooperation between teachers is crucial, also to keep enthusiasm alive.
- Pity most departmental meetings are used for logistics.
- Workload is an issue. Need of time for teachers to meet.