# **Video Talk 3: A Teacher’s Experience of using Project-Based Learning to Teach Mathematics**

Hi my name is Sandra Fay. I am a second level maths teacher at St Marks Community School in Ireland, and teach students aged between 12 and 18. In this video I’m going to talk to you about my experience of the Irish initiative Project Maths, introduced to you in Module 1. The aim of the initiative was to improve students’ mathematical competence and shift the focus in the classroom from teacher led drill and practice to developing the skills of problem-solving, higher order reasoning and sense-making. I’m going to share with you the challenges we faced in implementing this new approach, and also provide you with some top tips on how to develop these skills through your teaching.

There was an appetite for change in my school. We knew the system was broken so it had to be fixed. The maths classes were often teacher-centred. Predominately teachers demonstrated mathematical procedures and skills, and students practiced them. Essentially we were focusing on one type of learner and as a result at least 50% of the class was not engaged. As a school we were excited about the reform, which considerably revised the mathematics syllabus, pedagogy and classroom assessment which accompanied it, but we knew it would not come without its challenges. There were major challenges for the school, teachers, and students.

For the school there were many challenges including time tabling, team teaching organisation, IT resources, Training facilitation and meeting time allocation.

The principal had to ensure there was a whole school support, and that students, teachers and parents felt supported in the process. As the syllabus development happened in phases, teachers were working from different syllabuses.

1. New content was added while other content was removed from the syllabus, depending on its’ relevance to the overall plan.
2. There were no books and initially few resources. A lot of time was spent by teachers devising new resources of their own. There was also a lot of time spent discovering and exploring new resources online.
3. Time allocation was also a huge concern for teachers. Our routine was totally disrupted. As the syllabus and its content were changing and growing we did not know were the time would come from to cover the content.
4. We were worried about where the time for developing skills and focusing on projects, discovery learning, real life concepts, and group work etc. was going to come from?

Many teachers had to completely review how they understood their role in the classroom. There was a whole unease around the sense of newness. The challenge of new topics, new pedagogies, new assessment and new technology was facing us. We had two choices:

1. One was to embrace the challenges and take this opportunity and use it as a means of engaging our students. The hope being that our students would engage collaboratively, and learn from each other’s problem solving strategies. This would enable them to think creatively and critically in relation to maths and hopefully the real world.
2. Or alternatively do nothing and stay as we were focusing on lower order thinking and procedural maths, rather than real understanding and transferrable skills for the future.

We chose to embrace the challenges, and we were able to meet them thanks to five effective strategies. The first was **collaboration among the department**. Everyone in the department was fully on board, and we benefited from the enthusiasm and leadership of our department head also. As time was a huge challenge and developing resources was extremely important, collaborating and sharing resources was crucial to its success. We had a shared server where we uploaded our resources and made them freely available to all members of staff. There was a huge sense of continuity for the students as we were using the same T&L, PowerPoint’s, and resources for introducing and teaching all our topics. There was a real sense of alignment as there was a lot of discussion and debate among teachers around the logical order to teach each topic and for how long for. The whole unease around the newness created a strong nature of support amongst the staff.

The second important factor was the **intensive school support** we received. As a national initiative each pilot school was allocated a regional development officer to provide professional development support. Our officer was outstanding and delivered excellent workshops with great ideas for bringing real life scenarios into the classroom. She helped us develop resources, and overcome our fears and reservations around the constant changes in the syllabus. She was also available at any time online for advice. There was a real sense that we were in this together, and as a school we felt very much supported. Collaborative learning was evident amongst us all.

Thirdly, a **supportive leadership** was paramount to the success of the implementation in St Marks Community School. Our principal could see the appetite for change and she spurred it on. The support was endless - timetabling, team teaching, IT and resource investment, meeting times, and training times were all taken care of. There was a real sense of whole school support.

**Team teaching** was the fourth facilitating factor, which turned out to be an excellent experience. The young and old teachers were in a position to glean from each other’s expertise. It was also a major factor in enabling teachers overcome a lot of fears. Some teachers enjoyed and encouraged group work. Other teachers felt less vulnerable experiencing it alongside a confident colleague whilst finding their way. Other teachers were extremely competent using IT and were able to help and encourage the colleagues with the use of ICT in the classroom. Team teaching brought huge benefits to the department as a whole. The skill set of the maths department as a whole grew tenfold due to the collaborative sharing of resources and skills which would not have happened without the support and flexibility of the management.

Finally,the **use of IT** **to support learning** had a significant impact on our ability to change. Maths teachers embraced the use of statistical packages and also Geogebra. Geogebra changed the face of the maths classroom. Geogebra allows both student and teachers to do a lot of investigation and discovery learning in the area of coordinate geometry, Functions, Graphs, Calculus and trigonometry to name a few. This means more time can be dedicated to higher order thinking and analytical skills as the computer can carry out the mundane tasks at a click of a button. We also use Edmodo, which is an online learning platform. It provides a safe and easy way for our classes to connect and collaborate, share content, and access homework, and in so doing encourages a peer-learning and peer-support environment – both in the classroom and online. Both teachers and students are encouraged to post resources they may have found useful.

On the basis of my experience of using a skills-based approach and project-based learning in the maths class, my top four tips to teachers would be the following.

**1. Use project-based learning.** Introducing project-based learning, including group work and investigational tasks, is very challenging, as you have to make sure students stay on task and ensure their work load is shared evenly in relation to their abilities. However, from my experience, it is also extremely rewarding. I have implemented statistic projects with my students which allowed them to investigate and research topics they were interested in. Seeing statistics as a cycle through the project-based learning process - posing a question, gathering, collecting, analysing and interpreting results, allowed my students to see the importance and relevance of what they were doing. This process can be used across a range of topics, including Trigonometry, Algebra, and Calculus, or geometry as in the following example. Let’s say we want students to do a project about volume. Firstly we need to pose a question:

1. What is volume?
2. What data might we need to collect to find the volume of an object?
3. Let’s collect the data and analyse it
4. Let’s now look for patterns and interpret results. Can we come up with our own formulas ourselves?

Changing the way we question allows great scope for developing key skills in the classroom.

**2.** **Create an environment where students can make connections across the subject**

Realising that no topic is stand-alone and that everything in maths is related removes the time pressure for study and revision. Watching students make this discovery is really rewarding. Devising your own resources with cross curricular links is hugely beneficial. When students begin to look for connections and links across maths you see a huge improvement in their problem-solving skills, and higher ordering thinking and reasoning. The hope is they can then apply their knowledge and skills outside the classroom.

**3. Create rich tasks and encourage students to use different strategies**. Introducing new topics through a problem and no other information encourages students to draw on what they already know. When you give them freedom to answer the question in any format they wish, you discover the different ways students learn. Some students revert back to graphs, tables and diagrams, others like to use formulas and algebra, and others like to describe using words.

**4. Encourage students to discuss maths and justify their solutions**. Rote learning has become redundant, and students are now expected to exchange and take part in collaborative problem solving. They need to be able to relate the maths they learn to real life concepts. By asking students to justify their solutions, rather than just giving the answer by following procedures, you are also assessing their language literacy. This can be challenging, but it offers a lot of scope for ‘’think, pair, share’’ learning and self-assessment.

In summary, the success of the implementation of project maths in our school can be attributed to the enthusiasm of all involved as well as the effective collaboration between teachers, the department head, the principal, the regional development officer, and last but not least the students themselves. Through Edmodo students could voice their concerns, look for advice and help and most of all share resources. They became facilitators of their own learning. I hope the sharing of my experience has been useful and I encourage you to use the tips in this video to start engaging in investigative, project-based learning to develop your students’ competences.

Remember that you can access further reading and related resources to this session from our course library. We also encourage you to visit the course forum where you can take part in an ongoing discussion linked to this topic with fellow participants and instructors.