Improving knowledge retention through a deeper understanding and engagement in mathematics

Case study – Embedded Instructional Leader Pathway, Mathematics Growth Team

Vidya Srinath
Instructional Leader

Kingswood High School, located in Sydney's Penrith Valley, is home to Embedded Instructional Leader (EIL), Vidya Srinath. Working with colleagues and students, Vidya is based at the school to support, challenge and improve the pedagogical and assessment practices of mathematics educators in her own school.

The Embedded Instructional Leader Pathway (EILP) is a core element of the Mathematics Growth Team, aiming to improve student outcomes in mathematics and redefine the mathematical mindsets of children, parents and communities (Anderson, Boaler and Dieckmann, 2018). Being school-based and continuing to teach within the school allows team members to maintain currency with constraints and challenges faced by current teachers. It also improves their ability to provide personalised professional learning at the point of need for relevant individuals and teams of teachers (Martinovic et al., 2017).

Embedding the EILP into schools also means mentoring and coaching can occur with staff on site over a sustained period of time, which is a crucial part of implementing long-term changes in teaching practice (Cartwright, 2020).

Teachers of mathematics in schools where the EILP operates participate in contextualised professional learning including lesson observation, structured discussion on pedagogy, reflection on practice and action research.

Case in point: Kingswood High School

Kingswood High School is a comprehensive co-educational high school established in 1969 and located in the Penrith Valley. The school, in the traditional country of the Dharug people, has 984 students including 12% of students from an Aboriginal and/or Torres Strait Islander background and 10% of students who receive English Language Proficiency support. The school also includes a Special Education Unit supporting up to 60 students through the delivery of inclusive teaching and learning activities personalised to support student growth and development.

Key focus areas for the EILP at Kingswood High School

Focus 1

Retention of knowledge

Informal conversation with students and teachers identified that students did not retain knowledge they gained. Student surveys identified that they did not clearly understand the mathematical context and did not find relevance in their learning. Experience and knowledge was an important factor due to the number of early career teachers within the faculty. There was limited pedagogical knowledge of how to engage students to develop a deep conceptual understanding of mathematical concepts.

Using release time built into the timetable, Vidya observed staff lessons. She identified students needed visual representations to understand the concept at a deeper level before moving to abstract concepts.

Resources were developed using the Principles of CRA (Concrete – Representation/Pictorial – Abstract) framework (Mercer & Miller, 1992) to help students gain a deeper understanding of conceptual knowledge. Students' learning then focused on the process of "why" rather than "how" which helped them retain abstract concepts.

> "I was able to see how different variables and constants interact with each other. Suddenly, the previously confusing world of algebra became clear to me. I was able to solve equations with ease and even found myself enjoying the process."
>
> **Courtney, Year 9 student**

Focus 2

Professional learning and building relationships to improve collaboration within the faculty

Initial professional learning was delivered during faculty meetings with visual representation strategies that could be quickly and effectively implemented into classrooms within a short timeframe, typically a few days after staff experienced the pedagogical technique for the first time.

This included a wide range of professional learning around lesson structure, integrating:

- manipulatives, both physical (hands-on) and online
- pictorial representations including algebra tiles, the area model and the Singaporean bar model.
- concrete models
- online tools and applications like Desmos, spreadsheet.

Vidya was allocated a Mathematics Growth Team Trainer, Kuldip Khehra, who provided specific support that matched Vidya's context. With Kuldip's expert knowledge in the visual maths field, mathematics staff in Kingswood High school worked to develop pedagogical practices using visual representation of abstract concepts in order for all students to access the mathematical content at their stage level.

Vidya gained professional development through 1-1 support from her Trainer. Additionally, professional learning from experts in mathematical education pedagogies aided Vidya's professional growth. Strategies trialled in the classroom had a direct impact on student self-confidence and engagement. Survey results from professional learning delivered to the mathematics faculty showed that the support Vidya was providing allowed teachers to implement the strategies effectively within their classrooms.

Focus 3

Target support – working alongside teachers to improve student engagement

Targeted support included team teaching opportunities, demonstrations lessons, observation, building resources to implement in class, mentoring and coaching staff with co-designing lesson plan and reflection post lessons. This was during timetabled lessons and during time allocated through the EILP to allow support tailored to the specific needs of staff.

Observable impacts

The impact of the Embedded Instructional Leader Pathway at Kingswood High School is visible through a wide range of different elements including:

- **Growth mindset among staff**. Staff engage with evidence-based teaching pedagogies to trial innovative ways to engage students and provide deeper understanding. This has resulted in the implementation of different teaching and learning practices within classrooms with students experiencing more hands-on and investigative activities.
- **Increased collaboration**. Staff participate in formal and informal discussions with teaching and learning as a centre of focus. They seek and provide feedback to each other about pedagogical practices, share their experiences of student engagement, successfully implement strategies and discuss areas for improvement and modifications of the teaching resources.
- **Student engagement**. Staff implement the CRA framework moving from concrete experience to abstract concepts in their classroom. This has cultivated deeper student engagement and deeper understanding of concepts. Students improved their retention of knowledge, increasing their ability to access the curriculum at stage level. Students, who would have traditionally given up on the topic of algebra as an abstract concept, have been able to successfully demonstrate their knowledge through concrete or visual representations.

> "As a beginning teacher, who was not taught mathematics in these ways, nor had I tried such strategies before, I was able to develop a much stronger confidence and willingness to use these strategies independently in my other classes, as I was able to see in real time its benefits to students' understanding."
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> **Ailya, Mathematics Teacher**

Find out more

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