Case study
NIS PhM in Astana

Nazarbayev Intellectual School of Physics and Mathematics in Astana is a selective school known for high academic standards and a focus on STEM. The school emphasizes innovation in teaching; teachers are encouraged to engage in professional inquiry and many have shared their work at international conferences (e.g. 33 presentations at ECER, 24 at WALS last academic year) as part of a growing research culture.

School leadership actively supports such development efforts. The school allots 4 hours per week for teacher professional development and has courses on Action Research and Lesson Study. The school's priorities in recent years have included integrating new technologies (e.g. AI tools), strengthening its professional learning community (PLC) culture through research, and improving differentiation in instruction to reach every learner. This case study examines how an action research project was carried out under these conditions, focusing on teaching and learning quality.

Focus of the Enquiry

Initial whole-school lesson observations, feedback surveys, and an external review revealed that differentiation - tailoring instruction to different student needs - was a systemic weakness across the school. Teachers were largely teaching to the middle, and lessons were not consistently meeting individual student needs.

At the same time, analysis of student achievement data identified the Grade 8 cohort as the weakest in the school. Grade 8 had the highest proportion of low marks on internal assessments, indicating many students were struggling. Moreover, there were two classes which constantly had the highest number of students who get unsatisfactory grades in the last year. This combination of findings set the stage for a focused inquiry into why these Grade 8 classes were underperforming and how teaching and learning could be improved for that cohort.

- **Differentiation as a School-Wide Issue:** Both internal observations and a recent accreditation report highlighted that the school *"should improve differentiation to better support all learners."* Teachers acknowledged challenges in addressing varied student needs, and about 30% of Grade 8 students in an initial survey disagreed that their teachers knew their personal interests or needs in learning. This indicated a gap in personalized instruction.
- **Grade 8 Flagged for Improvement:** School data showed Grade 8 students had significantly lower exam results compared to other grades. Within Grade 8, there was wide variation between classes – some Grade 8 classes performed well, but at least two classes had persistently low outcomes. Class 8_1 and 8_2 were identified as the weakest sections, with the greatest number of students scoring at the minimum passing level. School leaders chose Grade 8 as the focus for action research, aiming to diagnose the root causes of these issues and implement changes to boost student learning.

Phase 1: Whole-Grade Survey and Its Limitations

To start, the research team conducted a grade-wide student survey across all Grade 8 classes. The survey asked students about various aspects of their classroom experience - lesson pace, clarity, engagement, teacher support, etc. - to pinpoint perceived learning barriers. The results were surprisingly uniform: students in all Grade 8 classes voiced similar concerns about their learning experience. Common student feedback included lack of task variety, insufficient challenging work for advanced students, and inadequate support for those struggling –

essentially, “not enough differentiation.” Students generally felt teachers taught the same material in the same way to everyone, which left some bored and others lost. On the surface, this suggested a broad need for more differentiated instruction, aligning with the school-wide observations.

However, this broad survey did not explain a critical puzzle: if all Grade 8 classes reported similar learning conditions and challenges, why were some classes faring much worse academically than others? In the survey, classes that were doing well academically gave almost identical responses about lesson quality as the classes that were underperforming. For example, students across all classes agreed at similar rates that “class time is used efficiently” and “we always have the materials we need.” Nearly every class pointed to a lack of individualized approach as a problem, yet their outcomes varied widely. In fact, when comparing end-of-term results, the top-performing Grade 8 classes vastly outscored the weakest ones, despite reporting the same issues and classroom experience.

This indicated that the initial survey, while useful for identifying general areas for improvement, had limitations. It captured students’ perceptions of teaching practices but could not reveal why two classes in particular were struggling so much more. The broad-brush findings of “not enough differentiation” applied to the whole grade and the school at large - it was a systemic challenge, but not one that differentiated the high-achieving classes from the low-achieving ones. The research team realized that to find the root cause of 8_1 and 8_2’s underperformance, they needed to dig deeper with a more targeted approach.

Phase 2: Focusing on the Two Weakest Classes (8_1 & 8_2)

Having identified 8_1 and 8_2 as the lowest-achieving classes in Grade 8, the team zoomed in on these sections for a comparative case study. Both classes started the year with similar baseline exam scores (and similarly concerning survey feedback), yet their trajectories began to diverge by mid-year. By the middle of the year, Class 8_1 showed noticeable improvement - their test scores and classroom performance had risen - whereas Class 8_2 continued to perform poorly, showing little to no progress. This divergence was confirmed by mid-year assessment data, which revealed that 8_1’s average scores had increased significantly from the start of the year, while 8_2’s remained nearly stagnant.

The contrasting fortunes of 8_1 and 8_2 raised an important question: What changed in 8_1 that did not happen in 8_2? To answer this, researchers and teachers conducted in-depth student interviews with Class 8_1. They asked 8_1 students to reflect on their learning experiences over the first half of the year and describe anything that had helped them learn better. The student responses were illuminating. Several common themes emerged from the interviews:

- Many 8_1 students reported a ***shift in their study approach***. *“At the start of the year, I just tried to get tasks done. Now I actually try to understand the material,”* said one student, highlighting a newfound emphasis on grasping concepts instead of rote completion of work. Others echoed that they began paying more attention to *why* and *how* things worked in lessons, rather than just memorizing facts.
- Students mentioned they became ***more proactive in asking questions and seeking help*** when they didn’t understand something. *“I used to keep quiet when I was confused,”* one student admitted, *“but now if I don’t get something, I ask the teacher or a classmate.”* This change meant misconceptions were addressed sooner. Some students attributed this to the teacher creating a more open atmosphere for questions.
- The class culture in 8_1 had grown more ***collaborative***. Students formed study groups informally and discussed homework or difficult topics together. *“We started helping each other. Before, everyone worked alone, but now we compare answers and explain*

things to friends," described another student. This peer support boosted everyone's understanding and confidence.

- Crucially, 8_1 students ***felt more confident*** by mid-year. Small successes on quizzes and positive feedback from their teacher motivated them to put in more effort. One student remarked, *"When I saw my test scores getting better, I realized I can do it. That made me want to study more."* The growing confidence became a virtuous cycle driving further engagement and improvement.

These qualitative insights suggested that Class 8_1's improvement was not due to any major new program or curriculum changes, but rather changes in student behavior and mindset (possibly encouraged by their teacher's subtle adjustments). The students had become more reflective and active in their learning process. In contrast, Class 8_2 had not exhibited these changes - prompting the team to investigate 8_2 more deeply in the next phase.

Phase 3: Investigating Student Engagement in 8_2

With 8_2 still languishing in terms of performance, the action research team hypothesized that the issue might lie in student engagement. The uniform survey results and 8_1's interviews hinted that simply teaching techniques weren't the whole story - perhaps 8_2 students were not engaging with learning in an effective way. To test this, the team decided to study the engagement in Class 8_2.

The team conducted a video-based lesson analysis with the 8_2 students. They recorded one lessons of 8_2 and then invited small groups of 8_2 students to participate in *"video-replay" focus groups*. In these sessions, teachers and students watched clips from the lesson recordings. They would pause the video at points and discuss whether students were engaged at that moment, and why or why not. Both the teachers and the students took turns pausing the video whenever they observed a notable change in engagement - for example, a student looking bored or, conversely, a lively discussion happening.

This collaborative video analysis yielded a crucial insight: the students and teachers had very different interpretations of "engagement." The 8_2 students tended to identify engagement only during moments that were *fun, exciting, or involved active participation*. For instance, in one video clip the class was doing a quiz competition game; the students immediately marked that as a highly engaging moment, saying they felt "awake" and interested because it was a fun activity. However, when the video showed a quieter segment where a few students were working through a challenging problem individually, the teacher paused and noted that some students were deeply concentrating (which, to the teacher, signaled genuine engagement in learning). The students, however, did not recognize silent focus or thinking as "engagement." In their view, being engaged in class meant *being entertained or directly involved* – essentially, *"if I'm not actively doing something enjoyable, I'm not engaged."*

From the teachers' perspective, this was an alarming revelation. The 8_2 students equated engagement with enjoyment and visible participation, rather than with mental investment in learning. They did not see listening intently, reading, or working through a problem as engaging - even if those activities were crucial for understanding the material. In other words, the 8_2 students lacked metacognitive awareness about their learning: they were not consciously connecting the effort they put into understanding content with the outcome of learning. Engagement, to them, was an external feeling ("It was interesting and fun, so I paid attention") rather than an internal process ("I was thinking hard and making sense of this").

This finding explained why earlier student feedback didn't flag anything unusual about 8_2 – the students didn't complain of boredom per se, and they thought they were engaged in class when something fun was happening. Yet, their learning was not improving, because they were often mentally *disengaged* during important learning moments. The video study showed

that 8_2's teacher was indeed trying various activities (including games, group work, etc.) to motivate the class – typical differentiation strategies - but when the novelty or excitement wore off, students would mentally check out. Simply put, the 8_2 students were going through the motions of class without actively processing the material, except when it was dressed up as an enjoyable activity.

Identifying this gap in understanding was a turning point. The team concluded that a lack of student metacognition and reflective engagement was a key barrier holding 8_2 back. The next step was to address this by explicitly teaching 8_2 students what engagement in learning really means - and equipping them with tools to become more reflective, active learners.

Phase 4: Intervention – Building Reflection and Metacognition in 8_2

Armed with the insight that 8_2's students needed support in developing *learning engagement* (beyond surface participation), the teachers implemented a targeted intervention centered on reflection and metacognitive skills. The idea was to help students become aware of their own learning process and to recognize that true engagement is connected to understanding and growth, not just having fun.

The intervention introduced simple reflection routines into Class 8_2's lessons. Over the next several weeks, these reflection-focused practices became routine in Class 8_2. At first, students found the reflections odd - they were not used to articulating their learning process. But gradually, the 8_2 students began to engage with these activities sincerely.

Results and Conclusions

The two-week intervention conducted with Grade 8 students at NIS PhM Astana aimed to explore how reflection could support engagement and metacognitive growth. Although limited in duration, the study revealed several important insights. Most students treated reflection tasks as formal requirements rather than as meaningful opportunity for self-awareness. Interview responses commonly consisted of general statements or "correct" answers, suggesting that students had not yet developed the skills or mindset needed for deeper reflection.

One of the central findings was that many students lacked metacognitive awareness. They found it difficult to articulate how they learn or why they struggled with tasks. Reflection, when prompted, was rarely analytical and often descriptive. As Zimmerman (2002) emphasizes, metacognitive skills such as planning, monitoring, and evaluating are essential for self-regulated learning, but these skills need to be ***explicitly taught and practiced.***

Despite this challenge, the intervention showed early signs of progress. Some students, when guided by open-ended and age-appropriate prompts, began to express emerging awareness of their own learning processes. For example, a few students noted that reflecting helped them realize what they had not understood during the lesson and what they needed to improve.

Several teaching strategies appeared particularly effective in encouraging both engagement and reflection. Group and pair work, role-based tasks, and short reflective discussions allowed students to participate more actively and think about their experiences in real time. Embedding brief reflections throughout the lesson also helped normalize the process and made it feel less like an add-on. These approaches align with Ryan and Ryan's (2013) model of layered reflection, which emphasizes regular, scaffolded opportunities to think critically about learning.

However, the reflections remained largely surface-level, reinforcing the conclusion that reflection must be explicitly taught. Van Manen's (1997) framework on levels of reflection

can guide teachers in helping students move from technical, task-based observations toward deeper personal and moral insights. Modelling the difference between simple description and critical analysis could help students understand what meaningful reflection looks like.

In conclusion, while most students in this short intervention had not yet developed strong reflective habits, the study demonstrated that reflection has potential as a tool for increasing awareness and responsibility in learning. To be effective, reflection should be embedded throughout the lesson, supported by discussion and examples, and treated as a skill to be cultivated. Teachers should also interpret student reflections thoughtfully, using models like those of Kolb, Ryan, and Van Manen, to better support learners in developing both cognitive and emotional engagement with their education.

Collaboration and Understanding Change

The project also revealed valuable lessons about collaboration and educational change. Teachers initially worked in subject-based mini-groups, but scheduling joint meetings proved difficult due to timetable conflicts. While leadership supported the work by offering space and encouraging participation, the absence of clearly defined roles within teams sometimes caused confusion and slowed progress. Some teachers also felt unsure how to interpret student data or lacked experience with research methods. In hindsight, assigning clearer roles and working with smaller, motivated groups might have improved coordination and ownership.

Despite these challenges, the project helped build a stronger professional learning culture. Teachers who conducted student interviews reported new insights into how their students learn, with several planning to use such interviews more regularly. These conversations shifted the teachers' understanding of engagement and revealed gaps they had not previously noticed.

References

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.

Ryan, M., & Ryan, M. (2013). Theorising a model for teaching and assessing reflective learning in higher education. *Teaching and Learning Inquiry*, 1(2), 99–111. https://doi.org/10.2979/teachlearninqu.1.2.99

Van Manen, M. (1997). *Researching lived experience: Human science for an action sensitive pedagogy* (2nd ed.). Althouse Press.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, 41(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2