Implementation of the Queensland Physics 2019 Syllabus – A Case Study in Curriculum Change

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Abstract

The introduction of the new Queensland Certificate of Education (QCE) in 2020 was the biggest change in Queensland's senior curriculum and assessment system in almost fifty years, which also saw the implementation of a new Physics syllabus as part of a suite of seven new science syllabuses. Along with the introduction of a 50% external assessment, this syllabus included three new summative internal assessment techniques – data test, student experiment and research investigation.

This paper outlines factors considered by officers and other stakeholders of the Queensland Curriculum and Assessment Authority (QCAA) in the development of the new Queensland Physics syllabus. By using student data and data from the QCAA's quality assurance processes following implementation, key measures of success are discussed. The benefits and challenges of using a common framework for all senior sciences are also considered by comparing assessment outcomes for Biology and Physics.

Introduction

In 2014, a review into Queensland's senior assessment and tertiary entrance processes was undertaken (Matters & Masters, 2014). The results of this review led to the overhaul of a system of externally moderated school-based assessment that had been essentially unchanged for over 20 years and saw the reintroduction of external assessment for senior subjects for the first time in over 50 years. This new Queensland Certificate of Education (QCE) system (Queensland Curriculum and Assessment Authority, 2016) began implementation in 2019, with the first students graduating in 2020.

In this article we explore how the Queensland Physics 2019 syllabus was implemented as part of a suite of science subjects to support Queensland's unique context. Other authors have already considered the implementation of this syllabus in terms of its cognitive demands (Johnson, 2023) and gender representation (Ross et. al., 2023). Still others, such as Fu & Clark (2019) and Ndihokubwayo, Uwamahoro & Ndayambaje (2020), have presented case studies of physics curriculum change from a teacher perspective. However, as employees of the Queensland Curriculum and Assessment Authority (QCAA) – the statutory authority responsible for the development and implementation of the new QCE system – the authors have a unique perspective on the curriculum change process.

Quality assurance data will indicate the degree of success in the implementation of new assessment techniques. Student achievement data from the new system will be compared to the previous one and comparisons made between outcomes for different syllabuses (i.e. Biology and Physics) within the sciences suite.

We also examine how global and local disruptions led to challenges with the implementation of this new system and its syllabuses, and the ways in which they were overcome.

Development considerations

In developing a new Physics syllabus for Queensland, the syllabus writers considered both how the subject had been historically implemented in the state and the challenges and opportunities likely to be presented by the new senior assessment procedures. The unique demographics of Queensland were also an important consideration.

The history of curriculum and assessment in Queensland

From the 1970s, students in Queensland were assessed using a system of externally moderated school-based assessment (QCAA, 2024b). In the most recent iteration of this system that was in place until 2019, 100% of a student's Physics results came from assessments written and marked by their teachers. To ensure comparability, these assessments were moderated by external panels of expert teachers and each school's subject results scaled using their performance on a common scaling test (known as the Queensland Core Skills Test) which was undertaken by every student in Queensland who sought tertiary entrance.

Clark (2022) describes the evolution of Queensland's Physics syllabuses over the school-based assessment period, up to and including their final iteration, the Physics Senior Syllabus 2007 (amended 2014) (QCAA, 2014c). This final syllabus was considered to be 'low-definition' (i.e. providing relatively little prescription) and described the subject in terms of 10 key concepts (e.g. Motion can be described in different ways) and 44 key ideas (e.g. Changes in motion result from unbalanced forces) organised under the headings Forces, Energy and Motion. It also described two mandatory assessment techniques:

- extended experimental investigations (EEIs) – open experimental inquiry tasks that could run for 4–13 weeks
- supervised assessments – 90–120-minute examinations which could include short items, practical exercises, paragraph responses or responses to stimulus.

This syllabus also provided an optional assessment technique, extended response tasks (ERTs), which were non-experimental tasks where students responded to Physics questions using research and secondary data.

In 2013, the Education and Innovation Committee of the Queensland parliament conducted an inquiry into assessment methods used in senior mathematics, chemistry and physics in Queensland schools. Its report (Education and Innovation Committee, 2013) documented the concerns raised by Queensland teachers, parents and other stakeholders with aspects of the assessment system in the 2007 Physics syllabus (Campbell, 2018).

The new senior assessment and tertiary entrance system

Based on the recommendations of Matters & Masters (2014), Queensland introduced the new QCE system in 2019, incorporating a combination of internal (i.e. school-based) and external assessments, and supported through a range of quality assurance processes including endorsement, confirmation and ratification (Figure 1).

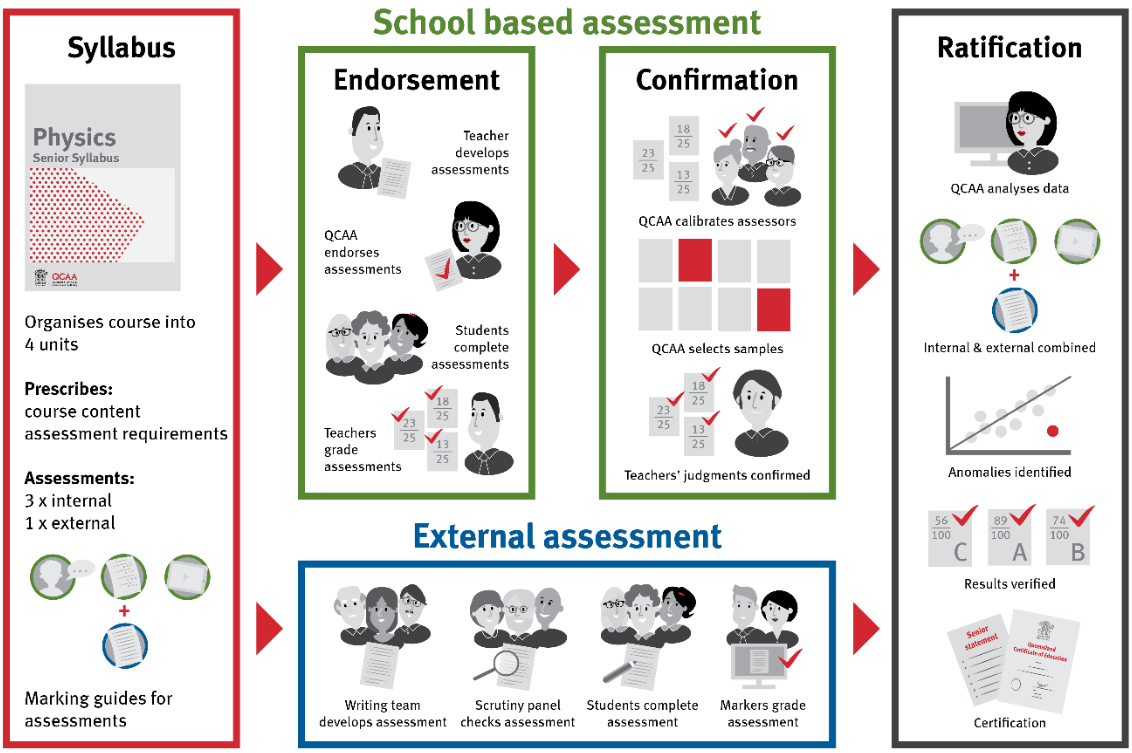

Figure 1: The Queensland Certificate of Education (QCE) system (QCAA 2016)

Syllabus development and implementation

Physics as part of a suite of science syllabuses

The introduction of the new QCE system necessitated the redevelopment of Queensland's entire suite of syllabuses. The redeveloped science curriculum contains seven General science syllabuses (Figure 2) whose results contribute to a student's Queensland Certificate of Education (QCE) and possibly their Australian Tertiary Admission Rank (ATAR).

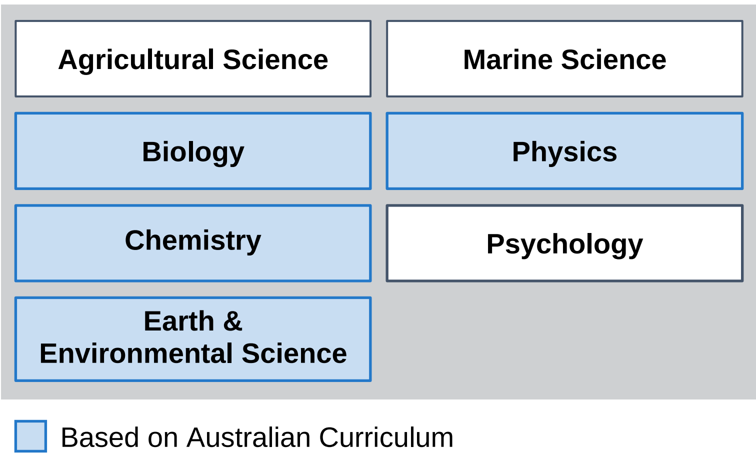

Figure 2: Seven General subjects in the suite of sciences developed by the QCAA

Four of these subjects correspond to subjects in the Australian Curriculum: Science (Australian Curriculum, Assessment and Reporting Authority, 2009). Two subjects, Agricultural Science and Marine Science, were developed from existing QCAA syllabuses. Psychology is a new subject that was implemented for the first time in 2019.

QCAA develops syllabuses aligned to senior Australian Curriculum subjects where they exist (*Education (Queensland Curriculum and Assessment Authority) Act 2014* (QLD)). As such, syllabus writers developed the new suite of science of syllabuses with a focus on the cognitions, skills and values implicit in the structure of the Australian Curriculum. In the 2019 Queensland science syllabuses this was done by using a common set of syllabus objectives and assessment techniques. These were underpinned by the approaches outlined by Marzano and Kendall (2007), with the Physics 2019 syllabus (QCAA, 2022b) sharing many features in common with the other syllabuses in the suite (Table 1).

Table 1: Common features across QCAA science syllabuses

Features common to all Queensland science syllabuses	Features unique to Physics 2019
• Syllabus objectives • Approach to teaching and learning • Assessment techniques and conditions • Marking guides • Reporting standards • Glossary of syllabus terms, cognitive verbs and qualifiers	• Rationale • Unit descriptions • Subject matter • Physics glossary of terms

Based on their previous experiences with implementing curriculum as teachers in Queensland, QCAA Science officers expected that developing the Physics syllabus to align with the other science syllabuses would provide several benefits:

- Physics teachers could form communities of practice with other science teachers in their schools to share teaching and learning strategies, assessment scaffolds and resources.
- Physics teachers in schools with minimal staffing would find it easier when required to teach other Science subjects.
- The economies of scale provided by a common framework for all science syllabuses would reduce the cost of producing resources to support Physics teachers. This would benefit both the QCAA and other resource providers (e.g. professional associations, textbook publishers) and provide Physics teachers with a larger range of support resources.
- In Year 7–10 Science classes, schools could map a developmental progression of teaching, learning and assessment skills to allow students to transition more easily into the senior curriculum.

There were significant challenges to developing a common framework for subjects as different as Agricultural Science, Physics and Psychology. For example, objective 3 of the science syllabuses requires students to ‘analyse evidence’. However, the analytical skills used in different science syllabuses varies significantly, as indicated in Figure 3.

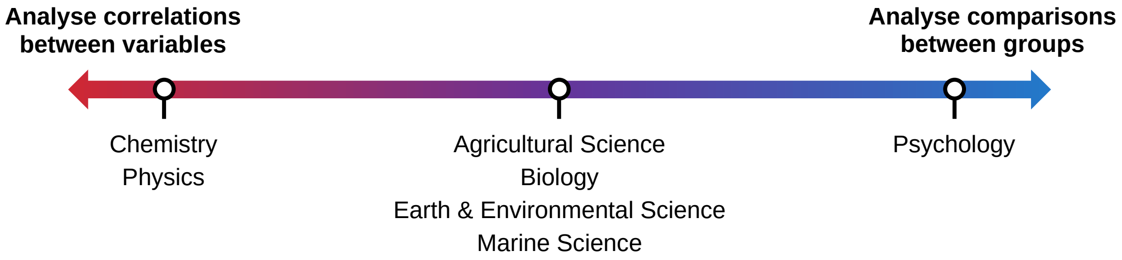

Figure 3: Science curriculum continuum of analytical skills

Consequently, the language used in assessment techniques and marking guides was carefully chosen to be valid across different scientific disciplines.

Subject matter

Like the Australian Curriculum: Physics (ACARA, 2018), the subject matter of the Queensland Physics 2019 syllabus is organised into four units. A significant challenge for the syllabus writers was providing enough guidance about what students need to know and be able to do for the purposes of assessment.

For example, Unit 3 of the Australian Curriculum describes the following subject matter from the Science Understanding strand:

- The vector nature of the gravitational force can be used to analyse motion on inclined planes by considering the components of the gravitational force (that is, weight) parallel and perpendicular to the plane (ACSPH098)
- $W = mg$
- W = weight force, m = mass, g = acceleration due to gravity (gravitational field strength)

The corresponding section of the 2019 Physics syllabus (shown in Table 2) illustrates some of the syllabus structures used to communicate the scope of the intended learning:

- cognitive verbs, e.g. solve, define, describe and calculate
- notional time for teaching the content
- guidance (as necessary) to elaborate on the extent of knowledge required
- formulas to be used when solving problems.

Table 2: An excerpt from the 2019 Physics syllabus

Subject matter	Guidance
Inclined planes • solve problems involving force due to gravity (weight) and mass using the mathematical relationship between them • define the term normal force • describe and represent the forces acting on an object on an inclined plane through the use of free-body diagrams • calculate the net force acting on an object on an inclined plane through vector analysis.	• Notional time: 4 hours • Forces acting on an object on an inclined plane include force due to gravity (weight), the normal force, tension, frictional force and applied force. Calculation of frictional force using $F_f = \mu F_N$ is not required. • **Suggested practical:** Conduct an experiment to investigate the parallel component of the weight of an object down an inclined plane at various angles. • **Formula:** $F_g = mg$ • **Syllabus link:** Students should be able to define Newton's three laws of motion and describe

Subject matter	Guidance
	examples of each (Unit 2 Topic 1: Linear motion and force).

Other features, such as the suggested practicals and syllabus links, were designed to help teachers and students make connections between units and the Science Understanding and Science Inquiry strands.

Assessment

Physics 2019, like the other syllabuses in the science suite, prescribes three internal assessments (IAs) and one external assessment (EA). Together, the three IAs contribute 50 marks to a student's subject result; the EA contributes the other 50 marks.

One of the recommendations of Matters and Masters (2014, p. 63) was that internal and external assessments should "be designed jointly to provide appropriate coverage and balance of the subject syllabus and in general should address different kinds of learning and achievement within the subject". Table 3 illustrates how the assessments of the Physics syllabus achieve this coverage.

Table 3: Alignment of the syllabus objectives to the assessment (QCAA, 2022b)

Objective	Internal assessments (IAs)			External assessment (EA, 50%)
	Data test (IA1, 10%)	Student experiment (IA2, 20%)	Research investigation (IA3, 20%)	
1. Describe and explain scientific concepts				●
2. Apply understanding of scientific concepts	●	●	●	●
3. Analyse evidence	●	●	●	●
4. Interpret evidence	●	●	●	●
5. Investigate phenomena		●	●	
6. Evaluate processes, claims and conclusions		●	●	
7. Communicate understanding		●	●	

The data test (IA1) is a 60-minute examination comprised of short-response items to assess students' ability to process, analyse and interpret experimental data using datasets based on practicals that the students have experienced in class.

In the student experiment (IA2), students modify a practical experienced in class to address a new research question. They perform the new experiment (usually working in groups) and then individually analyse, interpret and evaluate the results in a 2000-word written or 11-minute multi-modal response.

The research investigation (IA3) requires students to scientifically evaluate a claim provided by their teacher. They do this by formulating a research question, then analysing and interpreting evidence gathered from scientifically credible sources. Like the student experiment, students present their findings in a 2000-word written or 11-minute multi-modal response.

The external assessment (EA) is an examination that is set and marked by the QCAA. It consists of two 90-minute papers containing multiple choice and short response items that cover the subject matter of the final two units of the course of study.

The EA is the only assessment that directly addresses objective 1 (describe and explain scientific concepts). It does not directly address the objectives that are most strongly associated with the scientific inquiry process (investigation, evaluation and communication), since these are more authentically assessed in IA2 and IA3.

The decision to focus the internal assessments on the Science Inquiry strand reflects the finding that incorporating inquiry-oriented activities into physics courses increases student engagement (Creagh. & Parlevliet, 2014).

Ensuring comparability between IA results

Following on from Queensland's long history of school-based assessment in senior secondary schooling, it was essential that results from IAs continued to be valid, reliable and comparable between schools. Several features of the Physics syllabus have been designed to support the comparability of results.

For the IA1, the Physics syllabus provides detailed specifications for test construction, including the:

- objectives to be assessed
- number of datasets to be provided
- types of questions to be used
- proportion of marks to be assigned to each question type.

Table 4 illustrates how some of these specifications are presented in the syllabus.

Table 4: Mark allocations table (QCAA, 2022b)

Percentage of marks	Objective	Cognition and nature of response
~ 30%	2. apply understanding of gravity and motion, or electromagnetism to given algebraic, visual or graphical representations of scientific relationships and data to determine unknown scientific quantities or features	Students calculate, identify, recognise and use evidence to determine unknown scientific quantities or features.
~ 30%	3. analyse evidence about gravity and motion, or electromagnetism to identify trends, patterns, relationships, limitations or uncertainty in datasets	Students categorise, classify, contrast, distinguish, organise or sequence evidence to identify trends, patterns, relationships, limitations or uncertainty in datasets.

~ 40%	4. interpret evidence about gravity and motion, or electromagnetism to draw conclusions based on analysis of datasets	Students compare, deduce extrapolate, infer, justify or predict using evidence to draw conclusions based on analysis of the datasets.

Before a school's IAs can be used with students, they must be submitted for endorsement. Where QCAA-trained assessors determine that the IA meets the syllabus requirements, it is endorsed for use; if not, it is returned to the school, with feedback, to be amended and resubmitted.

The syllabus supports comparability of results by providing detailed instrument-specific marking guides (ISMGs) for each assessment technique. For IA2 and IA3, these ISMGs each group the assessable characteristics of a student response into four criteria (see Table 5 and 6).

Table 5: Criteria for IA2 (QCAA, 2022b)

Criterion	Objectives	Marks
Research and planning	2, 5	6
Analysis of evidence	2, 3, 5	6
Interpretation and evaluation	4, 6	6
Communication	7	2
Total		**20**

Table 6: Criteria for IA3 (QCAA, 2022b)

Criterion	Objectives	Marks
Research and planning	2, 5	6
Analysis and interpretation	3, 4	6
Conclusion and evaluation	4, 6	6
Communication	7	2
Total		**20**

Tables 7 and 8 show the Research and planning criteria for IA2 and IA3 respectively.

Table 2: Research and planning criterion from the IA2 ISMG that assesses objectives 2 and 5 (QCAA, 2022b)

The student work has the following characteristics:	Marks
• informed application of understanding of gravity and motion, or electromagnetism to modify experimental methodologies demonstrated by – a considered rationale for the experiment – justified modifications to the methodology	5–6

The student work has the following characteristics:	Marks
• effective and efficient investigation of phenomena associated with gravity and motion, or electromagnetism demonstrated by – a specific and relevant research question – a methodology that enables the collection of sufficient, relevant data – considered management of risks and ethical or environmental issues.	
• adequate application of understanding of gravity and motion, or electromagnetism to modify experimental methodologies demonstrated by – a reasonable rationale for the experiment – feasible modifications to the methodology • effective investigation of phenomena associated with gravity and motion, or electromagnetism demonstrated by – a relevant research question – a methodology that enables the collection of relevant data – management of risks and ethical or environmental issues.	3–4
• rudimentary application of understanding of gravity and motion, or electromagnetism to modify experimental methodologies demonstrated by – a vague or irrelevant rationale for the experiment – inappropriate modifications to the methodology • ineffective investigation of phenomena associated with gravity and motion, or electromagnetism demonstrated by – an inappropriate research question – a methodology that causes the collection of insufficient and irrelevant data – inadequate management of risks and ethical or environmental issues.	1–2
• does not satisfy any of the descriptors above.	0

Table 3: Research and planning criterion from the IA3 ISMG that assesses objectives 2 and 5 (QCAA, 2022b)

The student work has the following characteristics:	Marks
• informed application of understanding of gravity and motion, or electromagnetism to modify experimental methodologies demonstrated by – a considered rationale for the experiment – justified modifications to the methodology • effective and efficient investigation of phenomena associated with gravity and motion, or electromagnetism demonstrated by – a specific and relevant research question – a methodology that enables the collection of sufficient, relevant data – considered management of risks and ethical or environmental issues.	5–6
• adequate application of understanding of gravity and motion, or electromagnetism to modify experimental methodologies demonstrated by – a reasonable rationale for the experiment – feasible modifications to the methodology • effective investigation of phenomena associated with gravity and motion, or electromagnetism demonstrated by – a relevant research question – a methodology that enables the collection of relevant data – management of risks and ethical or environmental issues.	3–4

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• does not satisfy any of the descriptors above.	0

Within these criteria, each characteristic has several components:

- the quality of cognition being assessed – e.g. 'informed application of understanding to modify experimental methodologies'
- the subject matter context in which the cognition is assessed – e.g. 'gravity and motion, or electromagnetism'
- the evidence that the student will produce to demonstrate that the cognition has been achieved – e.g. 'a considered rationale for the experiment', 'justified modifications to the methodology'.

When teachers use the ISMGs, they focus on matching the qualities of student work to the descriptions of evidence (i.e. the final component of each characteristic).

Based on decades of experience of implementing reliable standards-based assessment in Queensland, expert writing teams comprised of teachers and academics worked in partnership with QCAA officers and a learning area reference group to choose the language of the ISMG characteristics carefully. Specifically

- the same language is used to describe similar features of the IA2 or IA3, e.g. both IA2 and IA3 ISMGs contain the descriptor 'a specific and relevant research question', the descriptors in the Communication criterion are identical for both tasks
- the same qualifiers are used at each level across criteria, e.g. the top-level characteristics are described as 'specific and relevant', 'justified' or 'considered', whereas mid-level descriptors are 'relevant', 'reasonable' or 'basic'.

This was designed to allow teachers to calibrate their judgments around a small collection of valued qualities.

The marks assigned to student work by teachers are considered provisional until they have been confirmed by trained assessors in a quality assurance process known as Confirmation.

Professional development and resources

In the 2016-2017 budget, the Queensland government funded an opportunity for every senior schooling teacher in the state to attend a full day of face-to-face professional development for the subject/s they taught (Queensland Treasury, 2016). They also had online access to a variety of implementation resources, including:

- sample teaching, learning and assessment plans
- sample IA instruments
- annotated sample IA responses

- sample EAs with associated marking guides and formula and data book
- IA quality assurance tools.

Since implementation, QCAA has continued to support teachers by:

- providing a trained officer for each subject to answer implementation queries
- training assessors
- hosting regular meetings of Science HODs
- providing online professional development on a variety of topics, e.g. flexible curriculum delivery, application of ISMGs
- providing access to their own senior student achievement data through an 'Analytical Dashboard' application
- publishing annual subject reports to provide information on trends in the design and marking of internal and external assessments, and statewide patterns in student achievement.

Challenges to implementation

In the initial years of implementation of the new Physics syllabus, Queensland teachers and QCAA officers faced several unanticipated challenges, such as the lockdowns and restrictions associated with the COVID-19 pandemic and natural disasters such as flooding, cyclones and bushfires that, amongst other difficulties, caused a three-month closure of QCAA offices.

QCAA responded to these challenges with a range of strategies including:

- reducing the number of IAs to be completed by students exiting Year 12 in 2020
- providing flexible submission timelines for IA quality assurance processes
- moving quality assurance and EA marking processes online
- providing professional development and training through online webinars.

Success of implementation

A variety of measures suggest that implementation of the new Physics syllabus has been successful.

Enrolment trends

In the leadup to implementation, some Physics teachers expressed an apprehension that the introduction of a 50% EA would deter students from enrolling in Physics. As Figure 4 shows, in the first two years of implementation there was a small dip in the proportion of Year 12 students who completed four units (or prior to 2020 completed four semesters) in Physics. However, in 2022, this returned to the long-term trend of 12–13%.

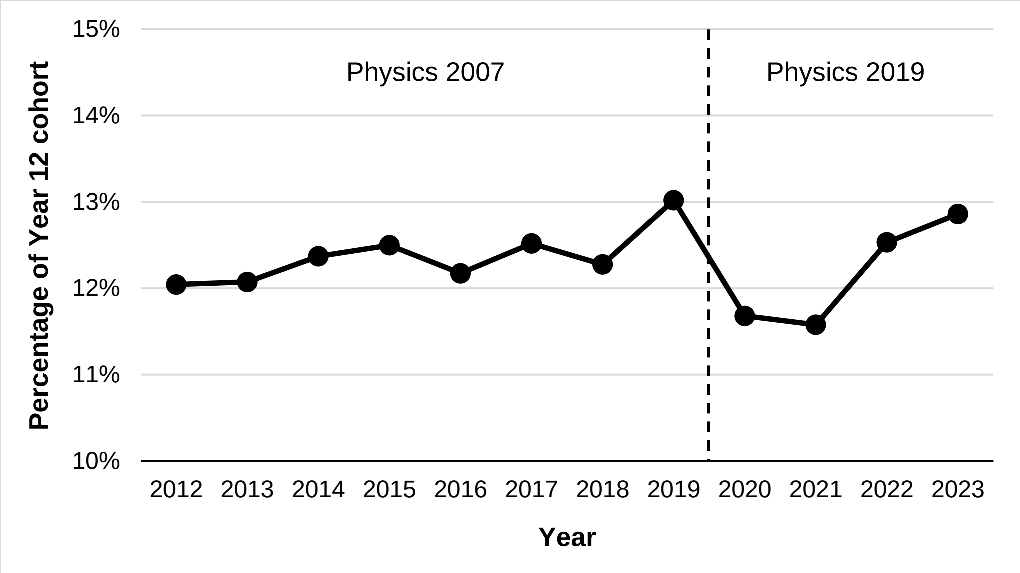


Figure 4: Percentage of Year 12 cohort enrolled in Physics (QCAA, 2021c; QCAA, 2024c)

Quality assurance outcomes

Figure 5 shows that the Physics syllabus has supported teachers to develop valid and accessible IAs. Most Physics IAs are endorsed at the school's first submission. IA1 is more difficult to design than IA2 and IA3 – the most common endorsement issue is that the test contains items that do not align with the syllabus specifications outlined in Table 3. In 2023, of the 393 IA1s submitted for endorsement, 90 were identified as having this alignment issue (QCAA, 2024b).

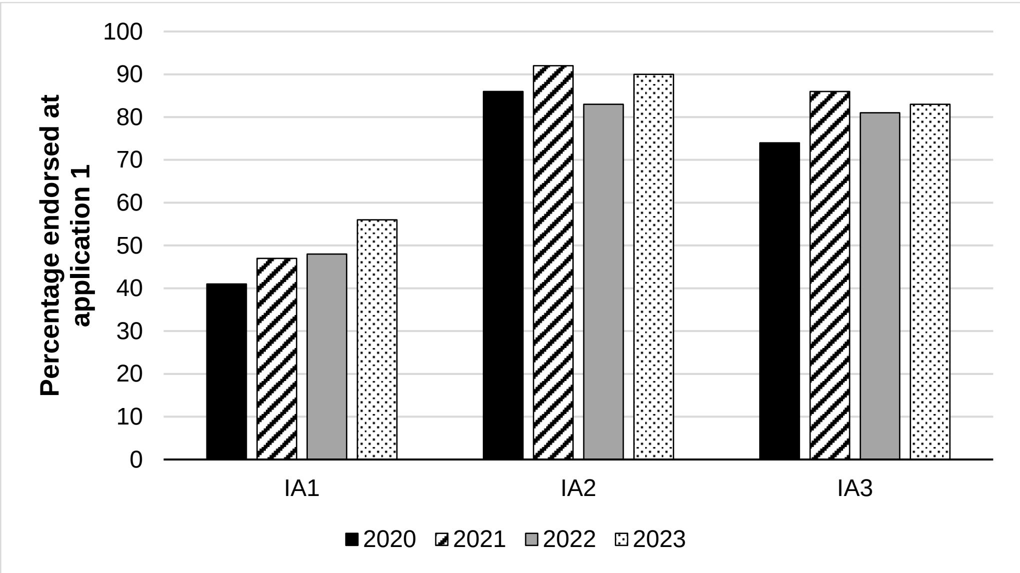


Figure 5: Percentage of Physics IAs endorsed for use with students after one application (QCAA, 2021b; QCAA, 2022c; QCAA, 2023; QCAA, 2024b)

Figure 6 shows that the Physics syllabus has supported reliable marking, with over 80% of teachers' (provisional) assessment decisions being confirmed by QCAA assessors. This is a particularly significant achievement given that, during this period, QCAA was not able to host the kind of face-to-face calibration activities that were common in the previous moderation system.

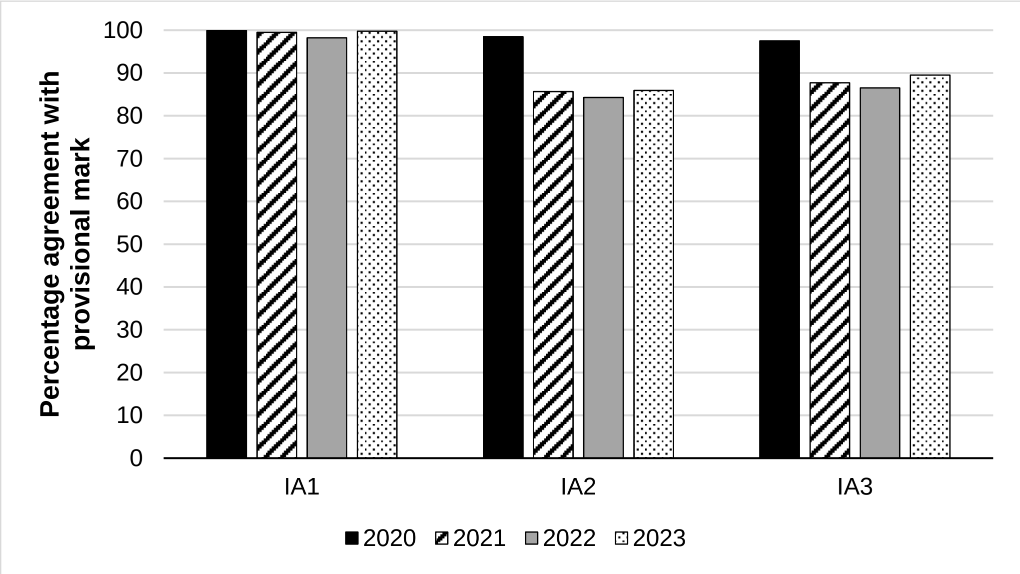
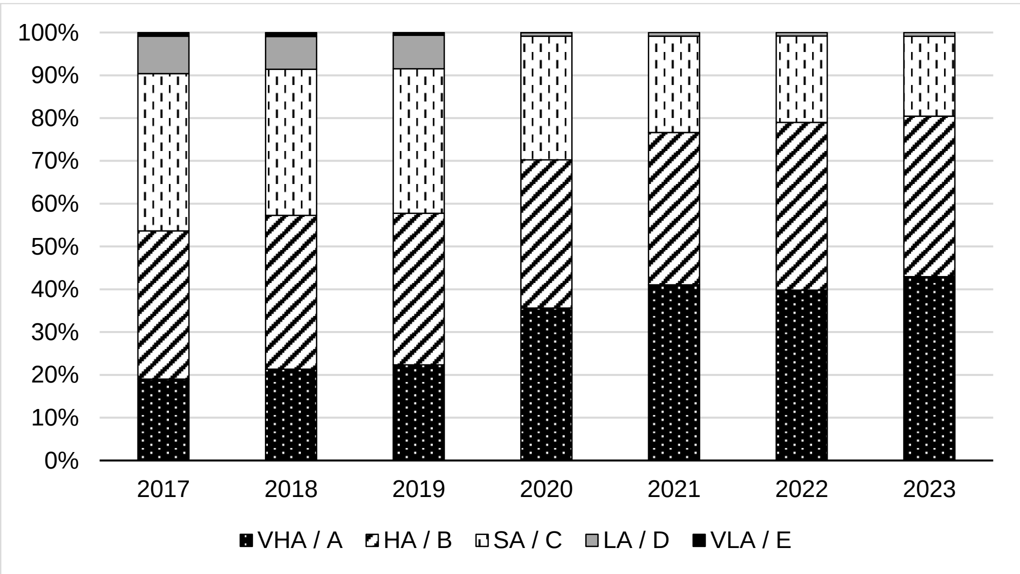


Figure 6: Percentage of provisional assessment decisions confirmed by QCAA (QCAA, 2021b; QCAA, 2022c; QCAA, 2023; QCAA, 2024b)

Distribution of results

The proportion of students achieving the top level of achievement (A standard) in the Physics 2019 syllabus is nearly double that of the 2017 syllabus (see Figure 7) with a corresponding drop in the proportion of students achieving the middle, satisfactory level (C standard).



Note: The 2007 Physics syllabus used reporting standards that range from very high achievement (VHA) through to very limited achievement (VLA). These correspond to the A to E standards in the Physics 2019 syllabus.

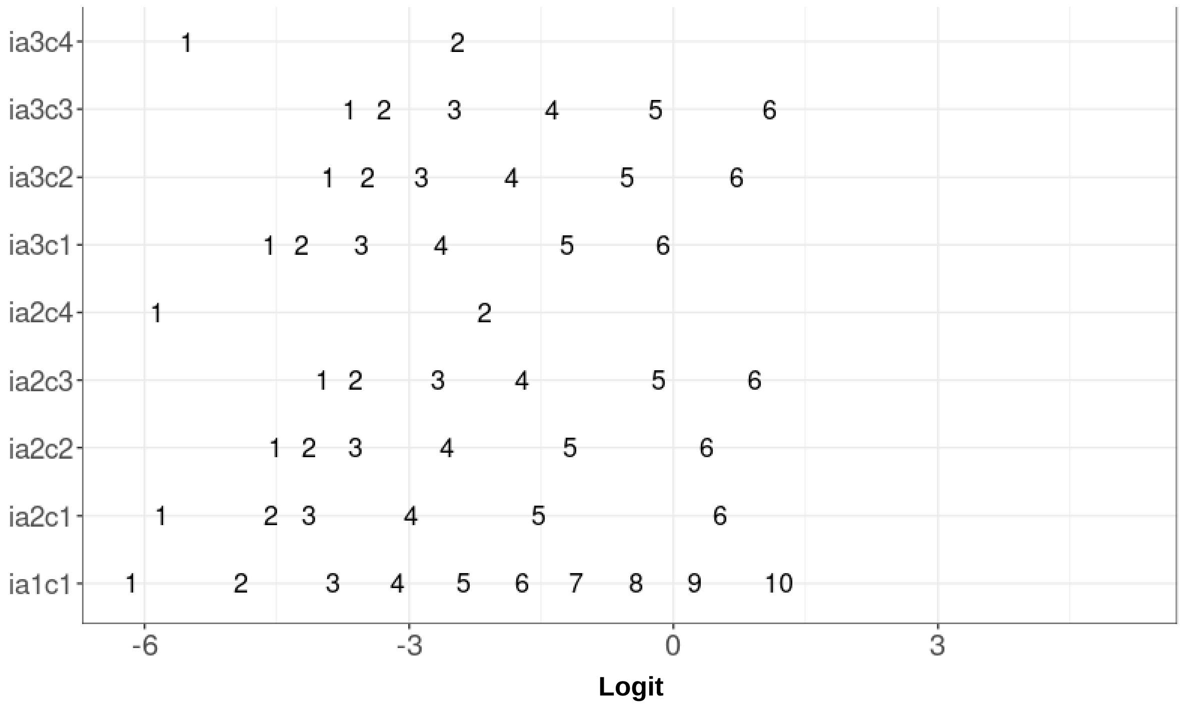
Figure 7: Comparison of student achievement as a percentage of the cohort (QCAA, 2021c; QCAA, 2024c)

Comparing IA results between subjects

The decision to use the same internal assessments and ISMGs across the suite of senior science syllabuses assumes that there is set of assessable cognitions that are common across all these subjects. This reflects research that suggests that biology, chemistry and physics teachers have similar expectations with respect to laboratory work (Buntine et. al, 2020, p.8). In contrast – earlier Queensland science syllabuses identified different objectives, assessable cognitions and assessment techniques for different science subjects (QCAA, 2014a; QCAA, 2014b, QCAA, 2014c).

As discussed earlier, experimental data can vary significantly between subjects (recall Figure 3). Consequently, the strategies and algorithms used to analyse this data also vary greatly. It is not necessarily apparent that a senior Physics student who analyses projectile motion data by constructing a scatter plot, linearising the data and determining a line of best fit is performing a comparable set of cognitions to a senior Biology student who compares ecosystem parameters using column graphs and Student's t-test. Similarly, when Physics students evaluate their experiments, they usually compare their results to known quantities and established relationships. In comparison, Biology students typically use statistical tests and measures to evaluate the internal consistency and variability of their data. The implementation of the new Queensland science syllabuses provides an opportunity to compare the relative difficulty of these and other cognitions as they are applied in Physics and other science subjects.

Each year, the QCAA uses Rasch analysis (QCAA, 2020) to produce an item map for the internal assessments of each subject. Figure 8 shows the item map for Physics in 2022. The logit scale on the horizontal axis gives a measure of the relative difficulty of achieving each mark in each criterion. The marks that students achieved most easily are plotted on the left of the map; the marks that students found most difficult are plotted on the right. For example, as expected, in the IA1 (ia1c1), students found it easiest to get a mark of 1/10 and hardest to achieve a 10/10.



Key: ia3c4 – IA3 criterion 4: Communication
ia3c3 – IA3 criterion 3: Conclusion and evaluation
ia3c2 – IA3 criterion 2: Analysis and interpretation
ia3c1 – IA3 criterion 1: Research and planning
ia2c4 – IA2 criterion 4: Communication
ia2c3 – IA2 criterion 3: Interpretation and evaluation
ia2c2 – IA2 criterion 2: Analysis of evidence
ia2c1 – IA2 criterion 1: Research and planning
ia1c1 – IA1 (this IA has only one criterion)

Figure 8: Item map for Physics 2019 internal assessments in 2022

This item map provides useful information about the relative difficulty of the various criteria in Physics. For example, students found that:

- of the 6-mark criteria, the Research and planning criteria were the easiest at most mark points (except for 6/6 in ia2c1), criteria involving analysis and interpretation were more difficult and criteria involving evaluation were the most difficult
- the 2-mark Communication criterion was the least challenging – the difficulty of getting 2/2 on either IA2 or IA3 was about the same as the difficulty getting a 5/10 on the IA1
- the difficulty of achieving full marks on IA1 was about the same as achieving 6/6 on the Conclusion and evaluation criterion in IA3.

Many of these patterns have intuitive explanations. The fact that students found evaluation more difficult than analysis reflects the order of these cognitions in the Marzano and Kendall (2007) taxonomy. Since IA2 and IA3 use the same descriptors for Communication, it is not surprising that these criteria performed similarly on the item map. However, the fact that these are 2-mark criteria is also likely to be a significant factor.

For the most part, these patterns were repeated across other syllabuses in the sciences suite. Figure 9 shows the item map for Biology in 2022. This bears a strong resemblance to the item map for Physics. Some examples of significant similarities include that:

- in IA3, criterion 1 (ia3c1) was consistently easier than criterion 2 (ia3c2), which was easier than criterion 3 (ia3c3)
- there was a similar pattern in IA2, except that a 6/6 on criterion 1 (ia2c1) was of a similar level of difficulty as a 6/6 on criterion 2 (ia2c2)
- achieving a 5/6 in IA2 criterion 3 (ia2c3) was a little more difficult than achieving 6/6 in IA3 criterion 1 (ia3c1).

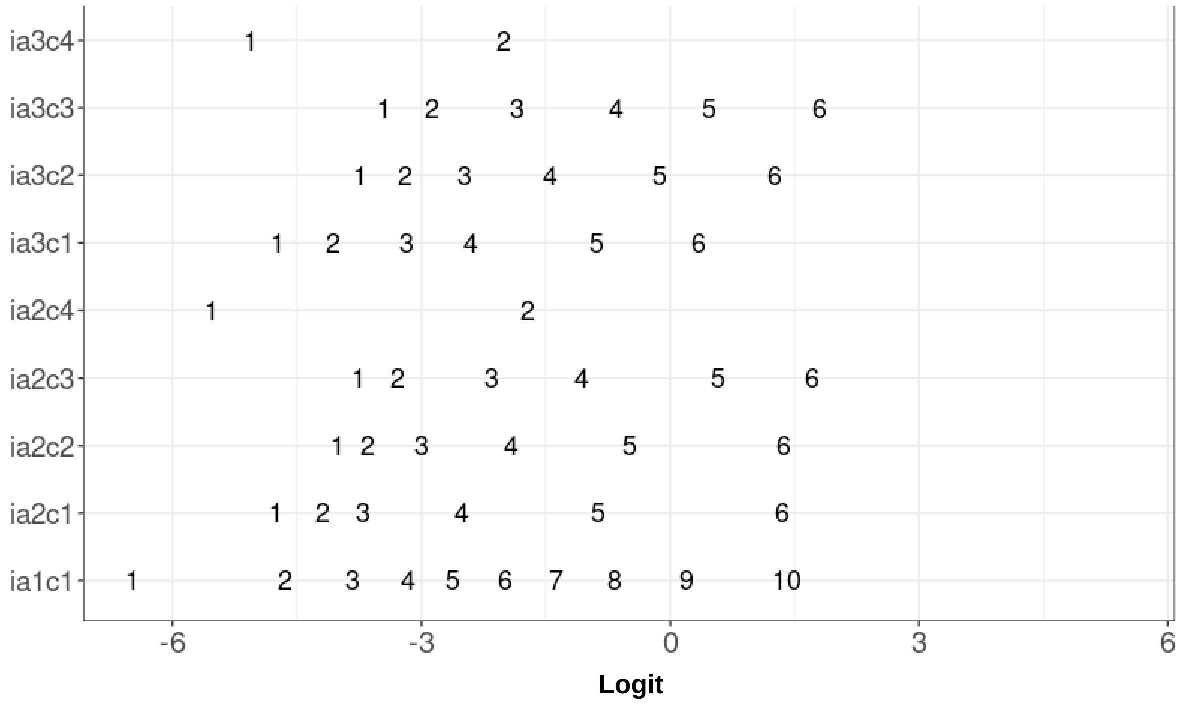


Figure 9: Item map for Biology 2019 internal assessments in 2022

There were similar patterns across many of the other science syllabuses, however, there were some points of difference in subjects with small enrolments, particularly in the Research and planning criterion for the student experiment (ia2c1).

These patterns have been repeated across the first four years of implementation, with the item maps from 2020 being very similar to the maps in 2024. This suggests that, on the whole, assessment outcomes have been consistent across the suite and that the strategy of using a common set of assessment techniques to assess common cognitions across the sciences has been valid.

Discussion

The goal of all those involved in the development and implementation of the 2019 Physics syllabus was that students in Queensland would continue to experience success in this subject as part of their studies within the new QCE system. This case study has identified some of the strategies that were implemented by the QCAA and its stakeholders to achieve this, including:

- developing a Physics syllabus that aligned closely with other science subjects to allow teachers to collaborate and share resources
- providing detailed subject matter based on the Australian Curriculum to clearly define the scope of learning required
- designing a suite of assessments that jointly assess the range of objectives identified in the syllabus
- implementing rigorous quality assurance processes
- providing a range of professional development opportunities and resources.

The evidence that suggests that the implementation has been successful includes that:

- enrolments in the subject have returned to their long-term trend
- quality assurance processes show a high percentage of assessments being endorsed on their first submission and a high percentage of teachers' judgments being confirmed
- a higher proportion of students are achieving at the top level than under the previous system
- assessment outcomes suggest that Physics teachers are implementing assessments in similar ways to teachers in other science subjects.

While the disruptions experienced during the early years of implementation due to COVID-19 and other natural disasters tested the resilience of Queensland teachers and students, they also impacted the validity of some of the data presented in this case study. For example, as noted earlier, one of the strategies used to manage the effect of COVID-19 in 2020 was to reduce the number of IAs implemented in each subject. In Physics, all but one of the 392 schools offering the subject implemented IA1, but only approximately 70% implemented IA2, and 30% implemented IA3 (QCAA, 2021b). Therefore, the 2020 confirmation data is not representative of the entire cohort, particularly for IA3. These disruptions also limited QCAA's ability to deliver its usual level professional development and training to teachers and assessors. Under more fortuitous circumstances, the implementation outcomes might have been quite different.

Conclusion

There is evidence that the implementation of the Physics 2019 syllabus, as part of a significant system-wide change, has been somewhat successful, despite significant global and local disruptions. Alignment of seven science syllabuses appears to have allowed teachers across the state to effectively support students. This is reflected in relatively high levels of reliability and consistency of judgements both within Physics and across the suite of sciences, identified through ongoing quality assurance processes and Rasch analysis.

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