Primary Curriculum Review and Redevelopment

Written submission template for organisations, groups and individuals responding to the *Draft Primary Curriculum Framework*

This template is intended to support you (and your colleagues/organisation) in developing a written submission in response to the *Draft Primary Curriculum Framework*. Please e-mail your completed submission to PCRRsubmissions@ncca.ie

Individual submission details

Name	
Date	
E-mail	

Organisation submission details

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Position	Science education lecturers in Initial Teacher Education throughout Ireland
Organisation	Irish Association for Primary Science Education
Date	25th of February 2022
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The NCCA will publish written submissions received during the consultation. The submissions will include the author's/contributor's name/organisation. Do you consent to this submission being posted online?

Yes [X] No [ ]

Please provide some brief background information on your organisation (if applicable).

Irish Association for Primary Science Education

Irish Association for Primary Science Education

Who We Are

A group of science educators working in Initial Teacher Education in the primary sector throughout Ireland

Mission Statement

We endeavour to ensure that children in primary school classrooms throughout Ireland experience a rich learning environment that promotes a deep understanding of scientific concepts and the development of scientific skills. This environment should support children in developing the requisite attitudes and values that will enable them to make sense of the world in which they live.

Our Aims:

- To provide quality science education within Initial Teacher Education in the primary sector
- To ensure classroom practice is informed by National and International research
- To support Continuing Professional Development for primary school teachers
- To collaborate with practitioners, policy makers and stakeholders in primary science
- To act as an advisory group on primary science

About Us

We strive to:

- Act as a lead body and national consultee for quality primary science education and by implication, quality Initial Teacher Education and Continuing Professional Development for primary teachers.
- Encourage greater connection between research and practice in order to support primary teachers in using innovative and up-to-date methodologies for teaching science.
- Collaborate with all stakeholders and organisations in primary science education.
- Act as a point-of-contact with regard to new developments in primary science education.
- Be at the forefront of thinking on curriculum, practice and research in primary science education.
- Develop and maintain capacity in teacher education in primary science.

Develop an informed and scientifically literate society (increase public awareness and understanding of science)

The remainder of the template includes two sections. Section 1 invites your overall comments and observations on the *Draft Primary Curriculum Framework*. Section 2 is structured to align with the six key messages related to the framework. Each message is summarised as a support for you in working on the submission.

Section 1

Please outline your overall response to the *Draft Primary Curriculum Framework.*

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The Irish Association for Primary Science Education (IAPSE) welcomes the proposed draft primary curriculum framework. All of our members, namely, science education lecturers in Initial Teacher Education throughout Ireland, have contributed to their respective institution's responses in terms of the overall structure and content of the Draft Primary Curriculum Framework. The comments made in this written response specifically relate to *science education* within the proposed draft primary Curriculum Framework. In this first section we provide an overview of our key responses to the Draft Primary Curriculum Framework. We elaborate further on these responses and include some additional reflections in the subsequent sections.

Key Competencies

Active Citizenship:

IAPSE maintains that it is essential that our young people develop the skills and attitudes that will motivate and empower them to take actions to live justly, sustainably and with regard for the rights of others. Scientific literacy and eco-literacy are integral components of being an active citizen (European Commission, 2015; UNESCO, 2019). It is vital that schools support students in developing their scientific and eco-literacies, so they develop the requisite knowledge skills and attitudes that will enable and empower them to understand different (socio)scientific issues and to make informed choices as young citizens. This scientific knowledge is particularly important in relation to issues regarding sustainability and climate change. IAPSE strongly suggests that reference to scientific literacy and eco-literacy would be included in this competency and that specific outcomes that address scientific and eco-literacy would be included under the competency attributes section.

Being Mathematical:

Scientific thinking is considered a key competency in the 21st century (DES, 2019). IAPSE proposes that the 'Being Mathematical' competency in the curriculum framework is renamed to 'Being mathematical and scientific" and that the descriptors would be adapted accordingly. See below for suggestions:

Being Mathematical ***and Scientific.***

- Thinking and communicating mathematically ***and scientifically***
- Solving problems and making sense of the world using mathematics ***and science***
- Estimating, predicting and calculating – possible change to ***Competently using mathematics and scientific skills***
- Recognising relationships, trends, connections and patterns within maths ***and our scientific world***
- Interpreting and processing information and data

Being a digital learner:

The fact there is a competency dedicated to *being a digital learner* and explicit reference

to pupils as '*critical users of digital technology'* places technology as aligned with the digital world exclusively, at least within this competency. This has implications for the "science and technology" curricular area being misconstrued as only referring narrowly to digital technologies. This is likely not intended but could confuse.

The draft cites: *'Being a digital learner includes problem solving and experimentation,* which have connections to a digital space, but in reality, in the primary classroom (in relation to science education) experimentation and investigations will be hands on, and may not *always* include a digital entity. Some thought about this would be useful, as it potentially limits the value of problem solving and experimentation outside of a digital context.

IAPSE are surprised that critical thinking is not highlighted as a key competency. In an age of information overload, it is increasingly important that children are equipped with the skills and understanding to evaluate and critique the information available to them. Perhaps critical thinking could be explicitly referred to in the descriptors of the key competencies.

Subject Areas

STEM Education

A recent report entitled "Technology and education in a post-Covid Era" asserts that while technology should be integrated seamlessly in classrooms it should always be underpinned by pedagogy (Egan, 2020). A succinct definition of the t "science and technology" is required in the primary framework. Many teachers interpret the 'technology' in 'science and technology' as 'digital technology' rather than the application of science knowledge and skills

IAPSE would suggest that rather than placing technology alongside science as another subject (science and technology), that technology within the primary curriculum framework would be positioned as an application of science and thus be represented as a strand unit or set of skills. Perhaps one way to address the potential confusion over 'science and technology' would be to keep the term 'design and make' in the descriptor and maintain "science" rather than "science and technology" as the subject/discipline within STEM.

STEM education is at its heart multidisciplinary and interdisciplinary. However, it is essential that for STEM education to be effective that it affords learners with opportunities to develop foundational disciplinary knowledge (e.g., science and mathematics), disciplinary skills (e.g., problem-solving, design, digital skills), and habits of mind (e.g., inquiry, evidence-based reasoning, logical thinking) associated with STEM disciplines. It is essential therefore that the primary curriculum affords our young people with sufficient opportunities to develop their foundational knowledge and skills in science and mathematics to enable them to apply this knowledge and skills for practical purposes (For example, through technology and engineering where appropriate and relevant).

Clarification is also required regarding the definition of 'technology education" at stages 1 and 2 and 'technology" at stages 3 and 4. Again, is this referring to digital technology or the current "design and make" component of the science curriculum. Digital

technology is not a curricular area rather a tool and a methodology.

A succinct definition of what STEM education entails as a curricular area for lower classes is required. IAPSE welcomes that science and mathematics are to be taught as subjects in their own right at upper level. However, some reference to the value of integrating the different disciplines within STEM education at upper level also would be beneficial. Exemplars could be provided in the curriculum specifications.

Social and Environmental Education

The concept of 'environment' is integrally linked with geographical **and** scientific inquiry. The subject area "Social and Environmental Education" (SEE) references the processes of life but "science and technology" has no mention of these or any environmental issues. In the context of global citizenship education, education for sustainability and climate change education, science and geography cannot easily be separated. IAPSE would strongly advise that the links between science and SEE would be explicitly stated in the curriculum framework and then examples of how these two subjects are interconnected should be provided in the curriculum specifications. Furthermore, IAPSE would suggest that it is essential that Environmental Sustainable Development Education is explicitly addressed in the new science and SEE curriculum specifications. In the absence of a holistic understanding of the connections between humans and the environment, there may be a risk of skewed perception of technological progress as the 'answer' to environmental sustainability issues. Science provides a key way of understanding the world around us, and how we share the planet.

Time Allocation

Research indicates that the time allocated for science in the current Irish primary curriculum (DES 1999) (at 4% of overall instructional time) is the lowest primary curriculum allocation for science amongst OECD countries (Clerkin et al 2016; Clerkin et al 2017; Eivers, 2013; Murphy 2013). That was when it was allocated approximately 4 hours a month as part of Social and Environmental Education (SESE) within SESE in the 1999 curriculum (DES, 1999). The most recent TIMSS cycle 2015) revealed that fourth class primary teachers in Ireland reported spending less time teaching science than any other of the 57 participating countries (32 hours per year in comparison to the TIMSS mean of 76 hours). A matter of further concern is the fact that the time allocated to science in Irish fourth classes in 2015 halved from 2011, where the average time teachers reported allocating to teaching science was 63 hours per year (Clerkin et al., 2016)

It is essential that there would be a significant increase in the time allocation for science as a subject in its own right within the Primary Curriculum Framework, to bring Ireland in line with other OECD countries. Lessons can be learned from Northern Ireland, where curricular reform in 2007 saw science combined with technology, alongside geography and history, in a curricular area referred to as the 'World Around Us' (WAU). Evidence from the Education and Training Inspectorate (ETI, 2015) exploring the implementation of the WAU has highlighted how some principals and teachers raised concerns around the lack of statutory duty to teach science overtly. They suggested that science may be diluted and that practical or investigative aspects may be limited or not take place at all. At the very least science should get parity with Social and Environmental subjects on the proposed framework. The application of technology to science and mathematics and indeed other subjects, has value as a cross cutting concept rather than a 'subject' solely connected to science as the draft primary curriculum currently positions it.

Section 2

Agency and flexibility in schools

The Draft Primary Curriculum Framework proposes that the redeveloped curriculum will:

- Be for every child.
- Recognise teachers' and principals' agency and professionalism to enact the curriculum in their individual school context.
- Give more flexibility to schools in terms of planning and timetabling to identify and respond to priorities and opportunities.
- Connect with different school contexts in the education system.
- Give greater opportunities for flexibility and choice for children's learning.

The *Draft Primary Curriculum Framework* outlines important messages in relation to agency and flexibility in schools. Please give your overall feedback in relation to this key message.

IAPSE broadly welcomes the monthly and weekly allocation of time as it gives teachers more flexibility. Monthly time allocations or flexible/discretionary time is welcome and offers scope for the teaching of discrete science concepts, within a thematic space that allows for cross curricular links to be made with other subjects. Careful use of discretionary time provides a valuable space to maintain the links that still exist between science and social and environmental education. This could be overtly articulated to scaffold important connections between science and the social and scientific environment, which interconnect as argued above. There is always a fear that monthly allocation may reduce teaching of explicit science concepts and skills, through infrequent engagement with science or subject time squeeze. Protected time for science within the monthly allocation might remediate this

Curriculum connections between preschool, primary and post-primary schools

The Draft Primary Curriculum Framework proposes that the redeveloped curriculum will:

- Provide a clear vision for children's learning across the eight years of primary school.
- Link with learning experiences provided through the themes of the *Aistear*: *the Early Childhood Curriculum Framework* and connect with the subjects, key skills and statements of learning in the *Framework for Junior Cycle*.
- Support educational transitions by connecting with what and how children learn at home, in preschool and post-primary school.

The *Draft Primary Curriculum Framework* outlines important messages in relation to curriculum connections between preschool, primary and post-primary schools. Please give your overall feedback in relation to this key message.

IAPSE welcomes that transition and continuity are important principles within the draft framework. While we agree that it is important to be aware of curriculum connections across the continuum of education, it is important that the primary curriculum encapsulates reasonable expectations for primary level.

Science, is a discrete subject at Junior Cycle and Leaving Certificate levels and requires students to have a grounding in key scientific concepts and skills and an understanding of the nature of science. This focus is aimed at ensuring students develop scientific literacy. Ideally, primary science education should start the process of developing students' foundational knowledge and skills in science. Primary science should adopt more holistic approaches to teaching science where children are encouraged to be curious, to ask questions and are afforded frequent opportunities to 'test' their ideas.

Nature of science and scientific literacy are not currently mentioned in the primary curriculum (DES,1999). However, when developing the new primary science curriculum specifications, it would be important that these aspects would be addressed given their centrality on the science specification at junior cycle

Emerging priorities for children's learning

The Draft Primary Curriculum Framework proposes that the redeveloped curriculum will:

- Embed seven key competencies across children's learning outcomes from junior infants to sixth class.
- Focus on developing children's skills, knowledge, dispositions, values and attitudes. The Learning Outcomes and the Key Competencies are broad in nature to describe this wider understanding of learning.
- Have increased emphasis on some existing areas such as PE and SPHE (Wellbeing) and digital learning, and have new aspects such as Modern Foreign Languages, Technology, Education about Religions and Beliefs (ERB) and Ethics, and a broader Arts Education.

The *Draft Primary Curriculum Framework* outlines important messages in relation to emerging priorities for children's learning. Please give your overall feedback in relation to this key message.

IAPSE welcomes the concept of embedding the seven key competencies across children's learning outcomes from infants to sixth class. We provided some suggestions for amending the *active citizen* and *being mathematical and scientific*) competencies in section one above. However, given the centrality of sustainable development and education for sustainability at government level both nationally and internationally, it would seem highly appropriate that sustainability would be included as an emerging priority for children's learning.

IAPSE broadly welcomes the monthly and weekly allocation of time as it gives teachers more flexibility. However, as mentioned in section one IAPSE has concerns regarding the current time allocation for science and recommend that the allocation of time for science is increased at the very least to bring Ireland in line with other OECD countries.

Furthermore, if STEM education is seen as a national priority, and as science is a core discipline of STEM, there should be a significant increase in the time allocation for science within the Draft Primary Curriculum Framework to bring the time for science more in line with the proposed time for mathematics, as detailed in the Draft document.

Given the nature of science as being investigative and inquiry-based, the five hour a month currently proposed time allocation could result in students having very limited science experiences. This is especially acute given that currently within the framework science is coupled with "technology".

Science has a similar time allocation at junior cycle/second level to other subject areas like geography, history, languages. This mismatch between curricular time allocations especially between social and environmental education and science and technology may have a detrimental impact on science interest, exposure, confidence and selection of science as a career possibility for students.

Changing how the curriculum is structured and presented

The Draft Primary Curriculum Framework proposes that the redeveloped curriculum will:

- Be broad and balanced in purpose and content.
- Be structured in five broad curriculum areas;
    - Language
    - Mathematics, Science and Technology Education
    - Wellbeing
    - Social and Environmental Education
    - Arts Education.

(In addition to the five areas above, the Patron's Programme is developed by a school's patron with the aim of contributing to the child's holistic development particularly from the religious and/or ethical perspective and in the process, underpins and supports the characteristic spirit of the school. These areas connect to the themes of *Aistear* and to the subject-based work in Junior Cycle.)

- Provide for an integrated learning experience, with curriculum areas in Stages 1 and 2 (junior Infants – second Class) and more subject-based learning in Stages 3 and 4 (third class – sixth class).
- Use broad learning outcomes to describe the expected learning and development for children.
- Incorporate the new *Primary Language Curriculum* / *Curaclam Teanga na Bunscoile.*

The *Draft Primary Curriculum Framework* outlines important messages in relation to changing how the curriculum is structured and presented. Please give your overall feedback in relation to this key message.

**Please note some of these points are represented in earlier sections but are synopsised here as overall feedback for your reference.*

IAPSE is in agreement that it is important to move to more differentiated subjects from third class to enable students to effectively explore the specific content and skills related to different subjects. As detailed in earlier sections, while curricular areas rather than subjects assist with timetabling and curricular overcrowding, the cross curricular areas should be based on a *best fit approach* and science could realistically be positioned in two curricular areas namely: STEM education and Social and Environmental Education (SEE). These connections should be acknowledged. At the very least, if science remains within STEM education, the valuable links to SEE, which are still hugely relevant in an era of climate change and education for sustainability, should be articulated and should not be not lost in a new vision of science solely as a discipline of STEM. At the same time, space for *science as science* is essential as science is one of the core disciplines of STEM.

As specifically mentioned in section 1, a clear succinct definition of STEM education in the primary curriculum is required as there is much uncertainty amongst primary and indeed secondary school teachers as to what STEM education entails. A clearer definition, expansion or elicitation of what is meant by "technology" is also required to delineate "science and 'technology' from the narrower portrayal of digital technologies mentioned in the competencies. For example, what is meant by traditional, contemporary and emerging technologies as mentioned in the science and technology preamble and do these not relate to other subjects beyond science, e.g., SEE, Mathematics.

To reiterate, while acknowledging the multi-disciplinary and interdisciplinary nature of STEM, IAPSE would strongly contend that primary school students should be afforded ample opportunities to develop their disciplinary knowledge and skills in both science and mathematics to enable them to apply these foundational competences in everyday contexts (including technology and engineering as appropriate).

Furthermore, if the primary curriculum is to foster children's interest in science and support them in developing foundational knowledge and skills in mathematics and science, this would facilitate a smoother transition to second level where students will engage with science and mathematics

and (for some) technology as discrete disciplines/ subjects.

Digital literacy is a core competency within the curriculum framework as it is a competency that transcends all curriculum areas and not just science. Without a succinct definition of STEM education, teachers may understandably assume that the technology in 'science and technology' refers to digital technologies which would result in further diminishing science.
The descriptor on science and technology (page 13) mainly references technology with a line at the end that includes science. In the context of the primary school this seems out of kilter and alignment with science being the foundation discipline in this curricular area.

Supporting a variety of pedagogical approaches and strategies with assessment central to teaching and learning

The Draft Primary Curriculum Framework proposes that the redeveloped curriculum will:

- Promote high quality teaching, learning and assessment.
- Conceptualise assessment as an essential and critical part of teaching and learning.
- Highlight the importance of teachers' professional judgement in supporting progression in children's learning.
- Encourage teachers to make meaningful connections with children's interests and experiences.
- Recognise the significance of quality relationships and their impact on children's learning.
- Recognise the role and influence of parents and families in children's education.

The *Draft Primary Curriculum Framework* outlines important messages in relation to supporting a variety of pedagogical approaches and strategies with assessment central to teaching and learning. Please give your overall feedback in relation to this key message.

Approaches
In terms of science education in the 1999 curriculum, the constructivist pedagogies underpinning the curriculum are welcome. Science is a universal global language and can operate as a vehicle which not only recognises but embraces diversity in a way that enables all children to learn and make progress in this area. Science transcends boundaries and encourages alternative hypotheses, viewpoints, approaches and possibilities, promoting global citizenship and embracing difference. These dimensions are broadly welcome, well voiced and succinct.

However, IAPSE contends that there could be a greater more explicit reference to Inquiry-Based Science Education (IBSE) pedagogies in the revised curriculum framework. The national and international science education research frequently cites the effectiveness of IBSE methodologies

in supporting the development of students' scientific knowledge, skills and in developing positive attitudes towards science (Rocard et al 2008; Murphy et al 2015; Murphy et al 2019; Smith 2014).

Assessment*:*
IAPSE supports the continued adoption of constructivist pedagogies whereby 'Assessment For Learning (AFL)' and 'Assessment Of Learning (AOL)', would form an integral component of teaching and learning in science. Exemplars of how different assessment tools (for example, concept cartoons, concept mapping, thinking and drawing) that could be used to seamlessly integrate assessment into the teaching and learning of science, could be provided in the science specification.

Building on the successes and strengths of the 1999 curriculum while recognising and responding to the challenges and changing needs and priorities.

The 1999 curriculum contributed to many successes including:

- Enhanced enjoyment of learning for children.
- Increased use of active methodologies for teaching and learning.
- Improved attainment levels in reading, mathematics and science as evidenced in national and international assessments.

The Draft Primary Curriculum Framework proposes that the redeveloped curriculum will:

- Address curriculum overload at primary level.
- Take stock of strategies, initiatives and programmes and clarify priorities for children's learning.
- Link with *Aistear* and *the Framework for Junior Cycle.*

The *Draft Primary Curriculum Framework* outlines important messages in relation to building on the successes and strengths of the 1999 curriculum while recognising and responding to challenges and changing needs and priorities. Please give your overall feedback in relation to this key message.

Irish students' attainment in science as evidenced in international assessments
With regard to the international Trends in International Mathematics and Science Study (TIMSS), it is apparent that Irish primary students are performing above the centre points in both science and mathematics, and mathematical performance amongst lower and higher achieving students

in Ireland has considerably improved since 2011. However, it is important to note that there were bigger improvements in mathematics than in science (Clerkin et al 2016; 2017).

In terms of science, while there has been a considerable improvement in the performance of lower-achieving fourth class students there has been a slight dis-improvement amongst higher achieving students. While fourth class students' performance in TIMSS 2015 in both science and mathematics has improved significantly since 2011, it has been asserted that this improvement could be as a result of improved literacy levels amongst students in Ireland, that perhaps facilitated easier engagement with the standarised tests, rather than actual conceptual improvement in science (Clerkin et al., 2016; 2017).

If STEM education is a national priority, and if inquiry-based approaches to teaching and learning science should be embedded in practice, it is essential that there would be a significant increase in the time allocation for science within the Primary Curriculum Framework to bring Ireland in line with other OECD countries, as detailed in section 1.

Covid-19

Since the publication of the *Draft Primary Curriculum Framework*, Covid-19 has presented a big challenge for schools. Please give your views on the implications of schools' experience of the pandemic for the finalisation of the *Primary Curriculum Framework*.

Data Protection

The NCCA fully respects your right to privacy. Any personal information which you volunteer to the NCCA will be treated with the highest standards of security and confidentiality, strictly in accordance with the Data Protection Acts. If you require further information related to data protection please visit www.ncca.ie/en/privacy-statement or you can contact the NCCA's Data Protection Officer at dpo@ncca.ie.

Thank you for your submission.

Please email your submission to PCRRsubmissions@ncca.ie