

IRELAND [2] - 2012

NCE-MSTL & NCCA COLLABORATION: DRAFT REVISED SENIOR CYCLE PHYSICS SYLLABUS - PHYSICS NETWORK

A. BASIC INFORMATION

Country:	Ireland
Title of initiative:	NCE-MSTL & NCCA Collaboration: Draft Revised Senior Cycle Physics Syllabus – Physics Network
Coordinator/ Organization:	1. Dr. Jennifer Johnston - National Centre for Excellence in Mathematics and Science Teaching and Learning (NCE-MSTL) 2. Anna Walshe - National Council for Curriculum and Assessment (NCCA)
Key competences addressed:	Initiative supporting the development of the Key Skills Framework (NCCA 2011) <ul style="list-style-type: none"> · Critical and creative thinking · Being personally effective · Working with others · Communicating · Information processing
Type of initiative and channels used for implementation (e.g. curriculum reform introduced through legislation etc.)	Curriculum review will be introduced through legislation. Linked to the national rollout of the draft revised Senior Cycle [upper secondary] Physics and Biology syllabuses.
Partners:	NCE-MSTL & NCCA
Scope: (student/teacher/school level; local/regional/national)	Teacher, student and school level Linked to national initiative
Learning context: (formal or non-formal)	Formal
School education level/s: (primary, lower secondary, upper secondary)	Upper secondary
Target groups:	Physics teachers and 5th year physics students
Time frame: (start and end date)	For this initiative: January 2012 – April 2012. Linked to the implementation of physics syllabus, for approval by NCCA early 2013. National rollout to follow. Date to be agreed. On-going impact on physics education in senior cycle classrooms.
Relevant links:	NCCA: www.ncca.ie NCE-MSTL: www.nce-mstl.ie Link to detailed project materials to follow shortly.

B. SUMMARY

The NCE-MSTL and NCCA Collaborative Physics Network has made a significant contribution to the forthcoming implementation of the revised Senior Cycle Science syllabuses in Ireland by designing, implementing and evaluating teaching and learning activities that aligned with and reflected the Inquiry Based Teaching and Learning (IBTL) approach, that embedded the 'key skills', and that probed for a deeper understanding of Physics from students.

This initiative is timely as it is informing decisions on assessment and Physics activities that incorporate the 'key skills' in high-stakes senior cycle subjects, the purpose of which was to promote an increased emphasis on student discussion, debate, critical thinking and problem solving. A key outcome of this project was the development of specific tasks that operationalised the learning outcomes (Millar, 2012) of the revised syllabus and embedded the 'key skills' in the learning outcomes. The study was evaluated through teacher interviews and lesson observations, video recorded lessons, student written work, and student presentations. The key findings emerging from this study in relation to the 'Asteroids, Impacts and Craters' task development played a major role in the development of the teacher resource material that is contributing to the rollout of the revised syllabus.

C. IN DEPTH INFORMATION

Rationale/contextual background/motivation for introducing the initiative/reform:

Researchers, policy developers, and educators are placing greater emphasis on developing students' ability to think critically and creatively, to be innovative and adaptive to change, to work independently and as part of a team, to be reflective learners and to be ready for the workplace in the 21st century (NCCA, 2011). In light of this the Irish Senior Cycle curricula and examinations are currently undergoing a significant phase of review. The changes are focusing on embedding the 'key skills' framework in the syllabuses. Consultation on the draft revised syllabuses for Senior Cycle Biology, Chemistry and Physics was conducted by the NCCA. In preparation for implementation of the revised syllabuses, a collaborative project was established between the NCE-MSTL and the NCCA with the aim of working with Physics teachers and schools to prepare exemplar items for inclusion to support teachers in implementing the revised Physics syllabus.

The aim of this collaborative project was to contribute to the draft revised Senior Cycle Physics syllabus and the national rollout of the Senior Cycle Science syllabuses by designing, implementing and evaluating teaching and learning activities that;

- align with and reflect the teaching and learning approach (Inquiry-Based Learning),
- embed the 'key skills' and operationalise the learning outcomes, and that
- probe for a deeper understanding of physics for students.

This initiative is timely as it is informing decisions on assessment and Physics activities that incorporate the 'key skills'. It is linked to the national rollout of the draft revised Senior Cycle Physics and Biology syllabuses, as teacher resource materials that complement these syllabuses is one of the main outputs from this initiative. Another major output from this initiative is a professional development framework that gives guidance on how to rollout the syllabus nationally.

Objectives:

1. To design and develop Teacher Resource Material - Tasks and Questions that complement the Revised Physics Syllabus
2. To design and develop a professional development framework for teachers to develop;
 - i. skills in designing and incorporating activities that develop and promote the 'key skills' within the Physics syllabus.
 - ii. skills and an appreciation of how to integrate Inquiry Based Learning (IBL) into their teaching and learning.
3. To promote the use of IBL in Senior Cycle Physical Science activities.
4. To investigate the teachers' and students' experiences of and attitudes to the teaching and learning of the developed Physical Science activities.
5. To investigate the development of students' 'key skills' and their understanding of topics throughout the course of the Physics activities implemented.
6. To design and develop assessment activities that align with and reflect the IBL Physics activities.

Dimensions targeted by the initiative/reform (e.g. student curriculum, assessment, initial/in-service teacher education, school autonomy etc.):

Physics curriculum for upper secondary students. Appropriate assessment for the new syllabus that would incorporate the key skills. Exemplification materials for teachers of senior cycle Physics.

Overall approach (e.g. holistic – existence of an overarching strategy, or targeted approach focusing on a specific dimension etc.):

The overall approach was a targeted approach focusing on the teaching and learning of tasks that built upon the concept of impacts by asteroids with planetary bodies and the craters generated following such impacts.

Detailed explanation of the key competence/s concerned:

A key outcome of this project was the development of specific tasks that operationalised the learning outcomes of the draft revised Physics syllabus and embedded the 'key skills' in the learning outcomes. The key skill framework identifies five key skills. These are information processing, being personally effective, communicating, critical and creative thinking and working with others. Embedding the key skills in the curriculum involves presenting the learner with a range of learning experiences. The key skills framework is an integrated framework reflecting the strong interrelationships between each of the five skills (NCCA 2011), for further information on the key skills framework see www.ncca.ie.

Specific subjects concerned or cross-curricular approach:

Specific subject: Senior Cycle Physics

How the initiative/reform is being implemented (e.g. process followed, political commitment, consultation with stakeholders and their respective roles, incentives for stakeholders, dedicated funding, teaching material, definition of goals and standards, assessment and evaluation mechanisms, impact on teacher training/professional development and school practices/leadership, scaling-up approach, based on research/evidence? etc.):

This initiative involved the participation of seven Physics teachers in a programme of Professional Development workshops specifically focusing on developing Physics teachers' skills in designing and incorporating activities that develop and promote the 'key skills' set out by the NCCA in the new Senior Cycle Physics draft revised syllabus. The project aimed to promote the integration of Inquiry Based Learning (IBL) into teaching and learning activities. Participating teachers' experience of the targeted CPD training and integration of IBL into their Senior Cycle Science classes were evaluated together with an investigation into their experiences and attitudes to the teaching and learning of the developed Physics activities. A further element of this research project was the evaluation of the development of students' 'key skills' and their understanding of the topics throughout the course of the Physics activities imple-

mented. The teaching and learning activities built upon the concept of impacts by asteroids with planetary bodies and the craters generated following such impacts. The project involved three full days of CPD workshops, and an active research element in class-time, which took place over a three-week period.

The purpose of Workshop 1 was to inform and engage participating teachers in the topics of 'asteroids, impacts and craters' and to engage them in an Inquiry Based Teaching and Learning (IBTL) approach and inform them of the key skills framework. Workshop 2 was a planning session and further developed the ideas and IBTL approach from Workshop 1. The teachers worked in partnership with the NCE-MSTL and NCCA in making informed decisions on the content and length of lessons after trying out the material in Workshop 1. Finally, Workshop 3 was designed to obtain feedback from teachers on the whole process. Teacher interviews and/or focus group meeting will add value to the data collected in the classroom.

The information gathered, including rich video evidence, will be available to provide exemplification materials for teachers to support national rollout.

Present stage/phase of implementation:

The active research element of the initiative has now been completed. The teacher resource material is being compiled and uploaded to NCCA website (link to follow in the next few weeks). The research report on the finding from the initiative and the professional development framework are in progress, which will give information on. This will provide useful information for the national implementation of the syllabus.

Pedagogical issues (issues related to how key competences are being taught to students and how are teachers being prepared to teach them):

Key pedagogical issues faced in this project were the implementation of the IBTL approach and embedding the key skills. The teachers who participated in this programme are well-regarded teachers and perform excellently within the confines of the Irish educational system. Senior cycle is a high stakes context and local innovation takes additional energy. The NCE-MSTL commends the time and effort given to this project by the participating teachers. The revised syllabus requires greater skill on the part of the teacher in being able to support teaching and learning activities that align with and reflect the teaching and learning approach, that embed the 'key skills' and operationalise the learning outcomes, while also developing the students' conceptual understanding of physics. The professional development framework utilised in this initiative advocates a hands-on minds-on approach where the teachers get to experience the key skills for themselves and move on from there to planning and translating that experience back in their own classrooms.

What works well (to identify enablers):

- Teachers as generators of real knowledge about what works in teaching and learning (NCCA, 2009a).
- Teachers are given time to experience and to tease out the key skills.
- Teachers are given the opportunity to try out the activities in their classroom and then share their experience with the community (Physics Network).

Challenges and how these are being addressed (to identify obstacles and solutions):

The key challenge is the national rollout of the syllabus. In preparation for the implementation of the revised syllabuses, the NCCA is working with teachers and schools to prepare exemplary supports for syllabus implementation and the key skills. Working directly with schools, teachers and students is increasingly a feature of how the NCCA informs its work on curriculum development and how it contributes, more generally to educational change. This initiative is playing a key role in the national rollout through the teacher resource materials that are being developed.

Monitoring & evaluation so far/planned, and which methods are being used (e.g. internal/external quality assurance, inspection, national assessments, international tests, self-evaluation, formative or summative evaluations):

Action Research was the overarching methodology applied to this initiative. A range of data was collected over the course of the project such as;

- pre survey, teacher interviews, students' written work, classroom observations, video (Class & Workshops), teachers' written work, written assessment questions.

The target group for this initiative was Physics teachers and their Senior Cycle students (5th year) studying Physics.

Impact (e.g. any planned impact assessment?):

The Physics syllabus, when implemented, will be assessed through a combination of written and practical assessment. The key skills are embedded in the learning outcomes of the syllabuses and will also be assessed in that way.

Communication of the initiative/dissemination of outputs and activities:

Communication and dissemination of the outputs of this initiative have been, and will continue to be, carried out through the NCCA website (www.ncca.ie) and the NCE-MSTL website (www.nce-mstl.ie), NCE-MSTL newsletter, and a research report. The initiative was presented at the Science and Mathematics Education Conference (SMEC) in June 2012 in DCU.

Next steps/follow-up:

The next step is the national rollout of the Senior Cycle Science syllabuses and a scaling up of the professional development framework to national level.

Additional information:

NCE-MSTL

The National Centre for Excellence in Mathematics and Science Teaching and Learning (NCE-MSTL) was established in 2008 to serve national interests and to address national priorities in the teaching and learning of Science and Mathematics. The role of the National Centre is to work with all stakeholders in Ireland to achieve improved outcomes in the teaching and learning of Science and Mathematics for all students at all levels of the education system. In practice this means that the National Centre is working with stakeholders to provide a better experience for students of Mathematics and Science at all levels; to improve standards and performance across the system and to increase take-up of higher level Mathematics and Science in schools. To achieve these ends the National Centre engages in research, projects and activities that focus on translating research into practice so that research findings impact Science and Mathematics in Irish classrooms. The Centre has evolved a three-pronged strategy to make this happen: best practice solutions are identified or developed through evidence-based research; solutions are piloted in appropriate interventions and evaluated; CPD materials are developed and disseminated through CPD events and the NCE-SMSTL website.

References:

- Millar, R., (2012, February) 'Starting from outcomes: Using Assessment to drive improvement in practice, Education in Science (EiS), 246, 6-7
- NCCA. (2011). Key Skills Framework. Retrieved March 28, 2012 from http://www.ncca.ie/en/Curriculum_and_Assessment/Post-Primary_Education/Senior_Cycle/Key_Skills_Framework/KS_Framework.pdf
- www.ncca.ie
- www.nce-mstl.ie

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