Key Skills in Senior Cycle

Teaching and learning through key skills

Biology
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1. Introduction

I feel students were strongly encouraged to become more effective as learners by me placing the focus on their learning rather than my teaching

This report is based on the work of six biology teachers who participated in the NCCA Key Skills initiative between September 2006 and May 2008. The methodology used and the key findings from the initiative are described in some detail in the Report on Key Skills at Senior Cycle published in 2008 on www.ncca.ie/seniorcycle. It is acknowledged that there is a lot of innovative teaching happening in classrooms all over Ireland and that this report presents a ‘snapshot’ of the practices of six teachers as they try to embed key skills into their teaching of biology. The report highlights how the use of key skills as a framework for planning teaching and learning fosters innovative practices and presents a picture of what is possible in embedding key skills in a given context.

The ability to think critically and creatively, innovate and adapt to change, to work independently and in a team, and to be a reflective learner are prerequisites for life and for the workplace in the twenty first century. In line with international trends and influenced by the OECD DeSeCo (Defining and Selecting Key Competencies, 2005) initiative, a framework of key skills has been developed as part of the curriculum and teaching and learning at senior cycle.

Following consultation, engagement with schools and research, five key skills have been identified as central to teaching and learning across the senior cycle curriculum. These are information processing, being personally effective, communicating, critical and creative thinking and working with others. These key skills play an important part in all learners achieving their potential, both during their time in school and in the future. They also enable learners to participate fully in society, including family and community life and the world of work.

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1 See for example the action research projects carried out by biology teachers at http://biology.slss.ie
Some of the elements that make up these skills are already a feature of current teaching and learning across subjects. The embedding of key skills in the curriculum will thus involve building on current practice but it also involves increasing attention to the skills and their potential for actively engaging learners. By embedding the key skills in the curriculum learners are presented with a range of learning experiences and outcomes that improve their present and future access to learning, their social interaction, their information and communication abilities and their ability to work collaboratively.

The key skills framework is an integrated framework reflecting the strong interrelationships between each of the five skills. As learners engage with each of the key skills they grow in their knowledge about learning and their skills of learning, both
in general terms and in the particular context of their own learning. Therefore, as learners develop the five key skills they also learn how to learn.

The findings on what worked well in embedding the key skills in biology classrooms are the result of action research by the teachers involved, who reflected on their practice and asked their students to reflect on their learning. NCCA provided teachers with individual feedback and suggestions on useful teaching materials which would help them in embedding the key skills in their teaching. Further reading and practical ideas focusing on topics such as learner autonomy, differentiated teaching and learning, formative assessment, cooperative learning and group work was also provided.

To facilitate the data gathering process, reflection tools were designed by NCCA in consultation with the teachers involved. The purpose of the tools was to provide teachers with support to encourage the process of reflection and to facilitate teachers and students in preparing their accounts of practice. The tools used were

- end of class reflection sheet
- end of topic reflection sheet
- meeting with colleague reflection sheet
- class planning reflection sheet
- student end of class reflection sheet².

All the data gathered was read and analysed by NCCA to identify themes or issues that emerged. To ensure that the data analysis was authentic and true to the voices represented, teachers were asked to read the analysis and give their feedback on the themes that emerged. In addition, it was possible with the teacher description of the class and their reflections, their students’ reflections and in some cases video evidence to triangulate to some degree of accuracy, a ‘picture’ of the teaching and learning in the class. Data was gathered in the form of reflection sheets, emails and notes from group seminars. Quotes from these reflections will be incorporated in the following sections to illustrate the findings.

² All the reflection tools developed through this initiative are available on http://www.action.ncca.ie/en/key-skills/tools-for-reflection
A group of the teachers are working with the NCCA on developing learning activities which are available on www.action.ncca.ie; these learning activities, with supporting materials, will serve to illustrate the findings of this report. Teachers are encouraged to try out the activities in their classes.
2. Embedding key skills in biology

Teachers quickly came to recognise that the embedding of key skills is intrinsically linked to methodology. To develop key skills effectively requires less whole class teaching and more active learning methodologies; they talked about how they were surprised how key skills appeared when structure and methodology is changed (biology teacher reflection). They reported that when key skills were the focus of planning, teaching and learning was more learner-centred and less content-centred. At the start of the initiative, many of the teachers spoke of ‘teaching for the exam’, and felt that their aim was to ‘cover’ the content. A ‘banking’ model of teaching was evident as teachers spoke with regret about having to fill the students’ heads with notes that could be regurgitated in an exam and ‘spoon-feed’ information that would guarantee their success in the ‘Leaving Certificate’. The students were largely passive recipients in this process and the object of the act of teaching. Changing this was difficult and not always successful as illustrated by the following quote

*Many students still expect to sit back and just absorb information from the teacher without any real effort on their part* (biology teacher reflection).

The subject of instruction (mathematics, biology, French, etc) was most prominent in planning for teaching. The introduction of a key skills focus changed this as teachers quickly began to shift the focus from what they needed to teach to who they wanted to teach, and how they wanted to teach. Teachers reported that they began to use more group work, pair-work, class discussion, peer-teaching and peer-assessment. The students had to take more responsibility for their learning. Teachers found that if you wanted students to be more personally effective and to think critically and creatively they needed to interact with the material being taught, develop their own notes rather than be given handouts and plan investigations in science rather than follow a recipe. The learners responded positively to this shift in power in the classroom as illustrated by the following reflections

*I definitely prefer being taught this way because you are more inclined to think through what you are doing and make sure you understand it fully* (maths student reflection) and, *you understand and it is not just notes in a hardback* (biology student reflection).

Teachers found that it was important to create classrooms where students could learn from their mistakes, where their confidence in learning was enhanced and where different learning styles were accommodated. The skills do not develop over a few
classes, the development of skills takes time and reinforcement in the teaching and learning is required on a daily basis.

The biology teachers all agreed that the five key skills were relevant to the teaching of biology and could be incorporated into learning in their classrooms. A number of common strategies emerged from their reflections and each is presented in this section. It has to be acknowledged that in most classes teachers used a repertoire of methodologies and that some methodologies are not mutually exclusive. For example cooperative learning was evident in many classes and incorporated into different methodologies. In the interest of clarity they are presented as separate headings in the report.

In addition, it is important to note that good teaching and learning is happening in classrooms all over the country and this report does not imply that only this group of key skills teachers was using these methodologies. Rather, it presents the reflections of teachers and students on their experience as curriculum developers in their classrooms using key skills as the focus. Fig 2 outlines the various methodologies used to develop the key skills.

![Diagram of key skills and associated learning activities]

**Fig 2** Key skills and associated learning activities
Co-operative learning

Working with others, being personally effective, communicating, information processing and critical and creative thinking were evident to varying degrees in any class where teachers used co-operative learning methodologies. This was evident in both teacher and student reflections. In classes where the key skills were the focus, teachers invariably tended to use and encourage co-operative learning methods. Initially teachers talked about ‘groupwork’ used for practical classes. However, on reflection after engaging with the learning outcomes associated with working with others teachers acknowledged that a lot of practical groups work at a very individual level following a ‘recipe’ for the experiment with no shared goal or investigative work. This passive way of learning does not encourage the development of key skills.

Strategies teachers used to encourage investigative work is dealt with further on in this report. Teachers used various co-operative learning methods with students in note making, such as the jig-saw method, peer teaching and so on and each are dealt with under the headings below.

Note making versus note taking

Teachers in the initiative reported that note taking had been more prominent in their classes than note making, and in some cases this was a practice that they had not questioned until taking part in the initiative. After reflecting on how the students learn in a class where they predominately take notes from an overhead or whiteboard, the teachers concluded that the learning was very passive and only suited a small number of students in the class. In their reflections students spoke of the ‘switch off’ taking notes was for them and how boring it could be you go from one class to another and all you do is write notes, in the end all you have is notes in a hardback that you do not understand.

In an effort to develop the skills of information processing and critical and creative thinking teachers encouraged students to generate their own notes. Many teachers reported that the students needed guidance and scaffolding to improve their skills in note writing. Initially students tended to write out full sentences with nearly as much information as the textbook. Teachers used various methods to scaffold note making. In the early stages it took a lot of time for students to generate their own notes but as
time passed, they got faster and more selective in the points they noted. The following are some examples of how teachers organised note making:

**Use of a variety of sources for information**  
Teachers provided students with information from a variety of sources such as video, books, newspaper, internet, and so on and asked students to distil out the main points. Teachers reported that this was an excellent method for embedding the key skill of information processing as students had to make judgement calls on sources of information and had to put the information into their own words. Working together and communication skills were also developed as students consulted within their groups on points and asked for clarification. This method encouraged learners to look in places other than the textbook for information and increased their interest in topics.

One teacher organised her students into groups to do a mini research project. Students were allowed choose which area of biology they would like to research. They then submitted their idea in a proposal form. The report on the project could take any form such as: making a model, designing a poster, carrying out a demonstration or showing the class a video or website. Students really enjoyed this work where they were developing their skills of information processing, communication and being personally effective. Some needed more scaffolding to complete the work but most students worked independently. Their reflections outline the main strengths of this method

> I learned a lot about doing research and having to choose material and present it. It was great to learn from other projects, there were some really interesting facts about things not in the book. I now know I can stand in front of the class and speak and defend my work. I was happy with the work that I done and that I achieved to meet my deadline.

The teacher was surprised at the level of engagement with key skills her students demonstrated. This is evident in the student reflection below on how the skill of being personally effective was demonstrated in the work.

> I made a small plan and this helped me decide what ideas that I was going to use. The plan acted as my checklist and guidelines so I knew what I had to do. I handed in all my research and work on time and kept to the deadline, I got my resources from my sister which was play dough for my model of the arteries (student reflection).
Use of groups for note making

The use of groups or pairs for note making was evident in many classes. After the teacher had taught a section of the course, students were divided into pairs or groups of four and given the topic to summarise. It was important that groups were kept small with not more than four in a group if possible. Clear guidelines were given as to the number of main points. Within the group, the students agreed the main points and noted them. Then the teachers took feedback from each of the groups on their main points and the class agreed the final set of points for everyone to note in their hardback notebook. While the end result of this exercise is the same as if the teacher put the points on the board or on an overhead projector, the advantage of doing it this way is that students are getting multiple chances to interact with the material and to make sense of it. Their skills of working with others, being personally effective and communicating were all being developed in the process. Students' end of class reflections supported this method of note making.

I’m learning my own notes. I’m separating it out into one thing at a time and it’s easier to learn, I find pictures and images go in quicker. It helps with my confidence (student reflection).

One teacher said students ‘talk’ the subject more and the results of the exams do improve. Some students do not like to ask questions in front of the class and prefer the safety of the group. As one student said when I worked in pairs I thought it was a big help because when I wasn’t sure of something I could ask the girl beside me so I wouldn’t have to say it in front of the class and make a show of myself. Clearly for some students they do not like talking and asking questions in front of the class, and they reported increased confidence in communicating in front of peers by working in small groups. Teachers reported that group activities encourage students to think critically and to work together, both vital skills in the workplace. In addition it encourages students to be personally effective in voicing opinions and listening to others (from reflections with my colleague, language and biology teacher).

The process was described in the following way in a student reflection sheet

We were divided into groups of three and one person was researcher, another person was the note-taker and the other was the speaker. The researcher read through the textbook and the group picked out the relevant information. The note-taker took down the points. Then the speaker read them to the class. Together we compiled a set of notes and wrote them into our notes copy. I think this is a good fun way of learning and we are not bored by the teacher calling out notes.
Use of the jig-saw method for note making
The jig-saw method for note making was used in a variety of ways, especially for revision of topics. In class, students are divided up into groups and each group is given a different section of a chapter to synopsise into a number of main points. Each group then has to revise that section for the class and share their notes with the other groups. Each student ends up with a set of points for the chapter.

*It definitely makes me want to move away from the traditional ‘notes’ based method of teaching because I was getting positive feedback from the students and although it means the class were talking more it was mostly about biology* (teacher reflection).

Teachers reported that feedback to individuals and groups was very important in this process. This proved to be a balancing act between intervening and standing back. They found that it was important to engage proactively with the groups as they worked and, on some occasions not to wait for questions. Teachers needed to engage the students by asking questions such as ‘take me through what you are doing here’ or ‘why have you done this, picked this point?’ Equally it was sometimes important to stand back and let the group work through the process. Teachers needed to know the students in the class if they were to get this right. Teachers reported that this took considerable time and effort on their part.

*It was ok if you had them in junior cert, you would have a fair idea of how they learn and their attitude to learning, but a lot of the time you meet them for the first time in fifth year and you have to gather a lot of information and observe them in groups to get a handle on how they work and learn.*

This skill of knowing when to intervene was evident in the teachers’ work.

Use of graphic organisers
The use of graphic organisers is closely linked with note making but can be used in a variety of ways. In some classes teachers used them to find out what students knew from junior cycle and in other cases they were used as revision exercises. There are many different examples of graphic organisers, teachers developed some and some were got from websites such as [www.educationoasis.com](http://www.educationoasis.com)

A teacher working with students in a fifth year mixed ability class with students studying both higher and ordinary level biology described how he used graphic organisers in the following way.
They worked in groups of three with one student acting as a summariser, another organiser, and a third a scribe. Each member of the group was given a question to answer, e.g. explain the mechanism of breathing. After a set time, they shared their answer, and constructed a graphic organiser using pictures, key words, statements and/or diagrams. They were provided with writing and colour equipment, rulers, compass, scissors, and sheets of paper to organise their thoughts and present their findings in a clear and understandable manner. On some occasions, the sheet of paper had one of the basic templates on which to organise their thoughts. After a set time, they initialised (to say they could explain it) and inserted their graphic organiser into a class poster. A reporter was drawn from each group to make a short presentation on their graphic organiser to the class. I moved between groups offering helpful suggestions, and gave an individual test to each student on the topic.

Fig 3 below is an example of one of the graphic organisers developed by the students in this class. For more examples visit www.action.ncca.ie

![Sample graphic organiser- vitamins](image)

**Fig 3 Sample graphic organiser- vitamins**

The teacher reflections on the process point out the need to scaffold the use of graphic organisers and to start out with templates and move on the letting the students design their own.

*Getting student participation was difficult at first. Interest was poor, and some of the graphic organisers were all over the place. There were moments of chaos.*
However, the students themselves provided some useful leverage when it came to tasks within the group. The fact that they had to present the topic to the class gave them further incentive to participate in the process. Students needed considerable support in the early stages when constructing graphic organisers. It does not just happen! Learning improved dramatically, but time prevented us from extending this methodology to other topics. Students are now reaping the benefits of this process as they revise for their Pre and Leaving Certificate exams.

**Mind-maps**

Many of the teachers used various forms of mind mapping for creating biology notes. Teachers reported that these really helped those students that were visual learners. It was noted that it took students a lot of practice to get the key words needed and to link the maps coherently. However, teachers and students felt this was worth the time as the visual representation of the topic made it easier to remember. In addition it was noted that students had to do their own mind maps as one teacher said *you can't map their minds for them.* Students did like to see each others’ mind maps, therefore displaying them or sharing them around the class is good. Students liked to work in pairs on their mind maps and did tend to learn from each others’ way of thinking.

The use of mind maps also encouraged students to make connections with other sections of the course and other subjects. This integration of prior knowledge is very important in biology and linking to other subjects such as geography, home economics, physics and chemistry. Lots of students used colour and diagrams in their maps. Teachers reported that they sometimes tend to think that because they are seniors they will not want to use colours and pictures, I found that most students loved using colour for mind maps and responded well to this method. Students commented that the use of colour helped them remember information when you draw diagrams you have to think about what you’re putting in them, it’s easier to remember functions; the diagrams you draw yourself stay in your head better. The colours stand out and you remember better. Fig 4 shows an example of a student’s mind map for Ecology.
Some teachers used mapping software with their students. The example in Fig 5 shows a mind map created by a student using software from www.inspiration.com this allows for detailed notes to be organised in one page. Animations can be included; in this example, the student has an animation of 'donate blood'. One student commented that you have to make them to understand them. The teacher noticed that there was a sense of achievement that had a positive effect on self-esteem, some were proud of their creations and were happy to photocopy and distribute them to others.
Poster presentations
Teachers reported that researching topics for a class presentation was a very effective method to embed the key skills of communication, working together, information processing and critical and creative thinking. When students had to engage with material in different ways they understood it better and were more inclined to integrate prior knowledge with new knowledge. The use of poster presentations featured in many classes. Teachers found this a particularly good way of getting all students involved in the learning. In teaching DNA structure one teacher divided students into groups and each was given a different aspect of DNA to research. They used textbook, handouts, newspaper articles, models, magazines and the internet to research the topic. Each group had to present to the class and design a poster. All the posters were put up in the classroom until this topic was complete. Teachers reported that it was important to change posters because if the same poster was up for the year the students just ignored them. With the students making posters for different sections of the course the teacher had access to a variety of posters and the students were interested in looking at each others’ work. Fig 6 shows an example of a student poster.
The following reflection from a teacher captures the learning where poster presentation was used in revising cell ultrastructure and cell continuity

*I found this lesson was great for showing students how to learn. They really got into making their own notes and didn’t rely on each other as much as usual because they were all doing it differently. It was useful to give them a page and say to them that they had to fit everything on the poster since it makes them summarise and pick out what is important. They enjoyed selecting the poster to put up on the wall and the students whose posters were chosen were delighted since they are not normally singled out. I felt it was nice for the best work to be chosen by their peer group.*

The students really enjoyed the class and felt they had a better understanding of the material. Students end of class reflections were all positive and confirmed the use of poster presentations as a method of learning.

*Its colourful, the explanations are short, you’re not trying to remember paragraphs. You have to spend more time and put more effort in and it’s easier to remember it’s easier to learn from diagrams, you know where everything goes. When you’d be staring at the book trying to learn it you wouldn’t be taking in everything.*

Students especially valued the opportunity to be creative and to show off their personal ‘take’ on the material. Clearly, in whole class teaching there is very little opportunity for individuality or for students to demonstrate their talents. The passive act of taking down
notes seems to stifle creativity in some students. Comments like the following were common in student reflections.

I like it, notes are boring, colouring is cool, and you can be creative. Everyone has their own way of drawing, when you're writing it's all the same.

Commenting on the use of poster presentations one teacher reported that there was definitely an increase in the number of students who asked questions and listened to their peers' points of view. I raised questions as to the ethics of certain processes e.g. genetic screening and got a great response. It was much better than just writing notes and really developed many skills in the students.

The students liked having to research a topic and to present their findings for the class as it broadened their knowledge of the topic and stimulated different questions for them on the content. When we discussed a certain topic and people asked loads of questions. I liked that a lot because I found I learned more. It was great having the posters up around the room as it helped me remember the main points.

Questioning
Teachers all reported that they had to revise their questioning practices in order to embed the key skills. They needed to move from asking short answer, lower order thinking closed questions to open higher order thinking questions. Closed lower order thinking (LOT) questions are useful to check for understanding during explanations or recap sessions. However, higher order thinking (HOT) open questions were better to stimulate thinking and learning. Changing questioning habits was not easy for some teachers and they reported that more class preparation was needed if you ask open HOT questions you must expect to get a range of answers and you must be prepared for this.

Teachers advised that when planning for a class a good habit to get into is to think of one or two HOT questions to ask students during class or for homework and only ask those two questions! Teachers reported using a ping pong ball questioning technique of firing off questions in rapid succession and giving little wait time to students to think. Teachers reported that giving 'wait time' and the 'no hands rule' were two good questioning habits and worked well. Giving sufficient time for students to formulate an attempt at an answer was very important. Teachers reported that they tended to rephrase the question or give the answer before the students had a chance to give an attempt at an answer. Students tended to stop thinking when a few in the class put up
their hands. Teachers noticed that when they used the no hands rule more students attempted the questions and seemed more focused on the question.

Teachers felt that it was important to create a climate where the learner feels safe to make mistakes and to learn from them. They found that allowing students to discuss answers with their neighbour or in groups before having to answer in front of the class helped students who lacked confidence in answering questions. Many teachers used class discussions, debates and think–pair–share exercises with the students to enhance their ability to answer HOT questions. Teachers reported that giving students thinking time resulted in significant improvements in student’s answers. Teachers gave the class the question, allowed 5 seconds for thinking/writing the answer. The student discussed their answer with their partner and decided what answer they wanted to share with the class. Students’ skills of being personally effective developed over time and their confidence in answering questions improved.

Discovery learning

Learning is more effective when students have been left to figure out something alone (previously I would have assumed they couldn’t do it so I’d just tell them), now they often come up with answers themselves (teacher reflection).

Teachers reported that it was important that students had to perform genuine experiments rather than follow a recipe for practical activities. Teachers acknowledged that where students had to sit passively and watch a demonstration or to simply follow a recipe practical there was little opportunity for skill development. There were many examples of how teachers got students actively involved in class. Whilst doing food tests one teacher made up different solutions and left one food group out in each solution. The class groups had to find out which food group was missing by experimentation. In other classes teachers did not tell the students the control and they had to work it out for themselves and explain how they came by their decision. In many classes students had to present their results and reach conclusions collectively on experiments. Teachers acknowledged that this way of investigating took more time and had to be planned for, however, they said it worked.

I believe you can get all the key skills in investigative work, when I got them working in this way they were thinking things through and confident about what they were discovering. They were also processing information and definitely learning.
Teachers reported that they found it difficult to hand over control in the practical work as traditionally students followed directions and in some cases never made any decisions around the process. The use of investigative methods in junior cycle Science needs to be continued into senior cycle. Teachers reported that they were surprised how they understood what they were doing and how they figured it out for themselves and gained confidence and a sense of achievement.

In demonstrations of practical work teachers asked students to predict what they thought might happen, then to observe the experiment and explain in their own words what happened. This Predict, Observe, Explain methodology takes the passivity out of practical demonstrations and engages the student in analysing and reflecting on what is happening. Students enjoyed the active participation in learning. I liked asking questions and closely examining the experiment and trying to understand what was happening for myself.

Use of peer teaching and assessment
In peer teaching the class was divided into groups and each group was given a topic to research and pick out the key points. Each group then had to teach their section to the class. They could plan for the teaching in class and each do some of the work for homework. They divided up their roles, getting the information, putting it on a flip chart and then teaching the topic. This is a good way of revising a long section of the course. The students reported that you remember it better when you have to teach it, and I listen more to my friends teaching than the teacher, they put it in easier language and give you hints on how to remember facts. Students got feedback from their peers on their teaching; this motivated other students to revise the topics and try to spot omissions. By the end of the class all groups had identified the key points.

Weaker students enjoyed this change in approach to peer-teaching from teacher dominated classes. They felt a sense of achievement when they were able to explain a small body of knowledge to the group. Better able students enjoyed explaining their section and sometimes being able to help the group complete the task (teacher reflection).

Timing was very important as each group was given ten minutes to teach their topic. The teacher was strict on timing so as to encourage the students to develop skills around organisation of material and skills of communication in teaching the main points using memory aids. The rest of the class had to give the teaching group feedback on
their teaching, in this way they were developing their skills of being personally effective in giving and receiving feedback. Teachers noted that sometimes the students taught them new ‘tricks’ for teaching and the students put a lot of work into the presentation of key points using a variety of way to communicate them including posters, mind maps, powerpoint presentations and so on. The class seemed to be more inclined to ask questions from their peers. The picture below shows a student teaching the class about population density.

In some classes students corrected each others' work and gave comments on where the answers needed to be improved. In some cases the teacher had generated a sample answer but it was not needed as the students in groups agreed an answer between them and invariably arrived at the correct information. However, some students reported that they did not like this exercise and did not trust their peers’ assessment. They said they preferred the teacher to correct their work.

Teachers reported that getting students to correct each others work on exam papers using a marking scheme was really useful in getting students familiar with exam technique.

**Use of games and quizzes**

Some teachers used quizzes and games to teach areas of the course. For example when teaching the skeleton, a teacher used a variety of methods, one of which was a
game to teach the names and positions of the main bones (See appendix 2 for sample lesson outline). The names were printed and laminated and the students had to label a member of their group. The students really liked the exercise and this is how one student described it:

*We worked in pairs for a lot of the activities, there was a lot of communicating and having to agree with partners to get the task completed. We had to agree on what we put in the notes. I was not afraid to communicate my ideas on what I thought we should include. Our group cooperated to get the work done and we stuck to what we had to get done.*

The teacher reported that

*the students are more engaged in the learning. They find it easier to recall information. Students are open to trying new things, the class time flies by, definitely a good atmosphere (more noisy though!)*

The picture below shows students 'playing pictionary' to revise definitions in biology.

In a revision class on digestion, respiration and photosynthesis one teacher asked pairs of students to pick out questions from past examination papers. Each pair had an examination paper from a different year. The questions were put on flash cards with the answer on the back. These flash cards were then used by the teacher to have a 20 minute table quiz on the topics. The class really enjoyed the exercise and each team wanted to win, consequently, they revised the topics very well. Typical students comments were *it's good because you are hearing it over and over again, it's easier,*
other people know them (the answers) if you don’t know them, it’s fun, if you’re put on the spot it makes you want to try harder.

The teacher was surprised by their enthusiasm for the exercise and felt it was a good way to get students familiar with the papers. However, the teacher did comment that 20 minutes was enough time after this, students seemed to get distracted and their interest was waning.

The use of true false cards proved very successful in some classes. Teachers had a card with true on one side and false on the other. Initially the teacher did these up on white card, but, after using them for a while, she made the following observation *I made the cards on plain white paper and realized later that it would be better if I had used a different colour paper on each side so that I could see instantly who was right and wrong.* Throughout the class, to check for understanding the teacher would ask a question and ask students to show their cards. In a very short time, the teacher could check for understanding. This activity could be taken further by asking students to justify their answers.
3. Benefits and challenges

The first phase of this initiative has promoted and encouraged active sharing of ideas for teaching and learning among teachers. It has stimulated innovative approaches by teachers to their teaching and as a consequence, it has promoted more engaged learning among students. It has also facilitated students in becoming more effective and reflective learners and to take more responsibility for their learning. It has affirmed the value of a key skills approach in teaching and identified practical ideas and methodologies that enable the key skills to be embedded within the curriculum.

This initiative set out to take a ‘snap-shot’ of teaching and learning at senior cycle and see what exactly key skills would look like in the classroom. What would be happening in a classroom where key skills are being developed? We are now much better able to answer this question. The teachers have informed us that the following characteristics are visible when key skills are being successfully embedded within the classroom.

- A diverse range of teaching methodologies is used with an emphasis on active and cooperative learning methodologies.
- A climate that values effort and encourages learners to learn to take risks and to learn from ‘mistakes’ is promoted.
- Diverse ways and rates of learning are valued and lead to increased respect and self-esteem for learners.
- Learning connects with students’ real world and provides enjoyment.
- Achievable but challenging targets are negotiated between the teacher and students and students are encouraged to reflect on their progress.
- Students are given more responsibility for their learning and the learning of others within the classroom.
- Students learn from each other as well as from the teacher.
- Students are given space to reflect on the learning opportunities created through the application of a key skills approach to teaching and learning.

We have also learned that embedding key skills in the teaching and learning presents us with some challenges. For key skills to really make a difference to the learning experience of students the following challenges will have to be addressed.
Time

Could do with more time for preparation for class, time was always a constraint. It took much longer to get the main points down on a page, but hopefully in the long run, it'll be more cost effective with respect to time, as students develop more confidence in their learning.

All teachers reported that time management was a challenge for them. The classes took longer to plan and prepare for. In-class time was a factor also as the more personalised approaches required more individual time with students and co-operative learning activities took time to organise.

There were many aspects to the challenge of time including
- organisation time, classroom time\(^3\), pedagogical time
- time for assessment, evaluating and reporting
- remedial time needed to help students with special educational needs and for communicating with special needs assistants
- collaborative planning time with subject departments
- individual planning time for class planning
- time to attend professional development events and to read literature to keep up with research in the area
- collegial time to meet and reflect on teaching and learning
- time of the year and pressure to cover the course and practice for the exam
- time for ordering, managing, and distribution of chemicals and equipment.

Habits of learning

Students are in bad habits from junior cycle and do not want to take responsibility for learning, they are used to being spoon-fed (teacher reflection from group seminar).

Students in senior cycle are so used to getting notes that they tend to judge the teaching on the quality/quantity of notes a teacher gives out. Students are not use to being independent learners and some resist the move from teacher led teaching to student autonomy in learning. Teachers reported that students trust the tried and tested approach; they are very suspicious and wary of change. This transition is easier where teachers use a repertoire of methodologies that include a mix of both teacher and

\(^3\) Teachers wanted one double class a week, two in the week was difficult to handle with such an amount of theory in Biology
student led learning. Teacher did feel that if all subjects were being taught this way that students would find it easier and would benefit far more in the long term. *I imagine this approach will reap most benefits when students go to third level where their key skills will really help them cope with independent learning.*

Teachers spoke of the impact the initiative had on their work and how their classroom were now more inclusive how *I can’t go back to handing out notes, morally I fell I am not doing them (the students) justice. This key skills way of thinking has become second nature to me.*

**Organisation of learning**

It is important that teachers are skilful in organising learning. Teachers reported that *it takes time to establish a good working relationship with students. It is worth considering doing an activity that promotes cohesiveness within the group.* All teachers involved in the initiative reported that the composition of groups was crucial to the success of group work, friendship groups did not work in biology classes. This is echoed elsewhere in the report when teachers said there was need to be competent in profiling students and consulting with them on their learning. Teachers found using the student reflection sheets very affirming and insightful, *I used the student reflection sheets and was pleasantly surprised.*

Teachers had to carefully plan for and stage manage group work. If students did not understand the topic or if they finished early before other groups, they just chatted. In some cases, the physical space for group work was a challenge; one teacher described the challenge presented by having 24 adolescent boys in a very small room. In another school, the high stools in the lab were very uncomfortable and in almost all of the student reflections, they said this impacted on their learning. In another case, investigative work was hampered by the availability of working sinks!

The importance of including students in the planning of classes was highlighted by some teachers

*When organising the class keep the ideas simple. It is not about the teacher it is about the work the students are doing that promotes learning and key skills. Students have to see the value in what they are doing and not see it as a once off fun activity* (from reflections with my colleague, English and biology teacher).
Content versus process and the exam

Teachers reported that the biology course is too content laden the biology syllabus is simply too long to be able to give this technique the time it requires (teacher reflection). If we use a key skills approach which is more focused on the process of knowledge acquisition then the exam will have to have questions that require application of knowledge. There will need to be practical assessment where scientific process is examined. If an investigative approach is to be used in biology then the number of practical activities will have to be looked at, one teacher expressed the need for time for genuine experimentation

learning through experimentation must remain a core activity in biology, however it may not be necessary to have so many mandatory experiments on the syllabus, students need to be able to act like scientists and to investigate, however, all this needs time and resources.

Resources, availability and sharing

Teachers all reported that the building up of resources such as animations, video clips, articles and lesson exemplars was very time consuming. The ability to access good resources can be difficult for some teachers. They did acknowledge that the NBSS website is very useful in this regard. However, there is no forum for them to share their resources and to get feedback on them from other teachers. They welcomed the meetings in NCCA where they got to discuss teaching with other teachers from different subject areas. Teachers reported that they do not get an opportunity to do this in their professional lives as most in-service is subject based and tends to be very content driven. Teachers are not encouraged to develop resources and tend to be given ready made resources to ‘try out’ in their classrooms. This initiative encouraged teachers to develop and plan their own resources and to reflect on how they worked in embedding the key skills. Teachers reported that this enhanced their professional knowledge in their subject area. Teachers valued the opportunity to meet and plan for teaching with colleagues from a different subject area it is easy to come up with ideas when we plan together, we help each other to expand our ideas and help overcome technical or access difficulties (from reflections with my colleague, English and biology teacher).