Peer based Webinars to Scaffold Inquiry Based Narratives and eTools

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Abstract - **This study sets out to tackle some of the challenges that science teachers face in adapting to an Inquiry Based Learning (IBL) approach in their teaching. The purpose of this action research inquiry was to encourage teachers to take part in peer based online webinars in order to learn how to incorporate inquiry based learning (IBL) using narratives and etools in their teaching. The series of webinars took place between February and April 2014 with a pilot group of post-primary teachers in Ireland.**

The research emerged from a concern at the lack of interest of students in Ireland to continue Science at Senior Level. The research was conducted in the context of the EU Inspiring Science Education (ISE) project which aims to provide digital resources and opportunities for teachers across Europe to help teachers make science education more attractive and relevant to students' lives. The evidence drawn from the research shows, how Inspiring Science Education (ISE) narrative templates scaffold science teachers as they compose narratives on the implementation of an IBL science lesson supported with eLearning tools.

Keywords - Learning in the Workplace; Webinars; Web Conferencing; Inquiry Based Learning; eLearning tools; Continual Professional Development.

I. INTRODUCTION

After the publication of the Programme for International Student Assessment (PISA) in 2003 [1], educational leaders in Ireland were concerned at Irish students' disengagement with science and there was a realisation that new approaches and attitudes to science education were required. Students attending post-primary schools in Ireland between the ages of 13 to 15 study Junior Certificate Science and complete the examination after three years of second-level study. In 2003, the Junior Science curriculum was revised to encourage the uptake of Chemistry and Physics in Senior Cycle by increasing the emphasis on an experimental approach to science education. The new curriculum emphasised the importance of the implementation of IBL into education to enable students to acquire scientific knowledge through investigation (DES 2003) [2]. The revised curriculum emphasised "doing rather than simply observing and learning off science" (NCCA 2006, p3) [3] with 35% of the Junior Certificate Science marking scheme set aside for practical work - Coursework A and B.

Since the introduction of the new science syllabus in Ireland in 2003, science teachers have highlighted a number of problems with the science curriculum. A survey by the Irish Science Teachers Association (ISTA) with regard to their experience of implementing the 2003 science curriculum (Higgins 2009) [4] showed that science teachers were concerned with students' inability to carry out the practical work themselves due to poor problem solving and science process skills. The syllabus failed, "at facilitating students in the development of skills, knowledge, understanding and attitudes that are appropriate in a society increasingly influenced by science and technology" (NCCA 2006, p21) [5].

The PISA 2012 results showed an improvement in Ireland's international ranking in science, however, the PISA assessments indicate that students in Ireland lack the skills to apply scientific concepts to complex real-life situations. These skills included the ability to think critically and the competency to construct and interpret evidence based explanations (Perkins et al. 2013) [6]. According to Engineer's Ireland Report of Taskforce on Education of Mathematics and Science at Second Level, which was conducted in 2010, 83% of first year science students in post-primary schools signaled that they would like to continue studying science at senior

level. However, after completing their Junior Certificate Science the same groups' interest in science had declined to 39% (Engineers Ireland, 2010) [7].

The current Junior Certificate Examination will be replaced by a new examination called the Junior Cycle Student Award. It is intended that new assessment approaches will start with the Junior Cycle Science in 2015 and this provides a positive way forward for IBL. It will be introduced on a phased basis and students entering second level education from 2015 onwards will study the new Science Curriculum and the first certification will be in 2018. The new Junior Cycle will have a school-based approach to assessment focusing on the process and product of learning through a combination of student's work during the final two years of the cycle and a final examination. The final assessment will be just one element of a broader school based approach to assessment. While details of the actual new curriculum have not yet been published there is a lot of important detail has been published in the DES document "A Framework for Junior Cycle" (DES October 2012) [8].

The purpose of the European project Inspiring Science Education project (ISE) is as follows:

> *…to significantly contribute to the implementation of the "Digital Agenda for Europe" and in particular Action 68 "Mainstream eLearning in national policies for the modernisation of education and training, including in curricula, assessment of learning outcomes and the professional development of teachers and trainers" , and to the wide adoption of the recommendations of the Rocard Report "A new Pedagogy for the Future of Europe" (Rocard et al., 2007) [9], that sets the basics for the introduction of the Inquiry Based approach in the science curricula of the Member States. (ISE, 2013)*

It is the intention of the ISE project that students will be inspired to use eTools and digital resources to learn Science, Technology, Engineering and Maths (STEM related subjects) in a practical, competitive and exciting way (http://www.inspiring-science-education.net/project). Increasingly eTools and resources are being accessed by students through mobile devices, for example, smart phones and tablets.

This study sets out to show how Inspiring Science Education (ISE) narrative templates scaffold science teachers' in their use of an IBL approach, as they compose narratives on the implementation of an inquiry based science lesson supported with eLearning tools so support the teaching of science.

The paper will be structured as follows: Section 2 will present the use of a synchronous e-learning environment, in the form of a webinar to support Continuing Professional Development (CPD). Section 3 outlines the methodology and structure of the CPD course. Section 4 presents the monitoring and implementation of the action research study.

II. Section 2

Our work to date as partners in the ISE project included the facilitation of a number of webinars in order to support the continuing professional development requirements of a pilot group of 21 teachers so that they are able to make use of the ISE eLearning tools and resources to support student learning in science. The purpose of a selected number of the webinars was to provoke ideas about how teachers could integrate IBL into their practice by showing them how to write and implement ISE narratives. In this paper, we will focus on the webinars that were designed to support ISE narratives.

Webinars or web conferencing are live interactive presentations transmitted over the Web. Web conferencing supports live, two-way communication and encourages interaction between teacher-student and student-student. Synchronous web conferencing software include features such as audio, video, application sharing, chat and Q&A that enable two-way, real-time communication. The webinars can be recorded and played back at a later date.

The literature shows that web conferencing provides students with the opportunity to develop their practice through structured discussion with one another, and it also provides opportunity for reflection and situated learning within a community of practice (Pratt, 2008) [10]. There is a suggestion that synchronous elearning environments may offer advantages over asynchronous learning environments. Yang and Liu identified three issues with asynchronous environments that limit the learning process. These include: (1). No human teacher expression and explanation. (2). No synchronisation and match between course materials and their explanations. (3). A lack of contextual understanding, just-in-time feedback and interaction (2007, p. 172) [11]. Web conferencing is seen as a cost-effective and viable alternative to traditional face-to-face presentations (de Gara & Boore 2006) [12]. It can reduce travel expenses and time, and facilitate teachers who are geographically dispersed (Britt 2006) [13]. The anonymous nature of synchronous chat facilities may also encourage people who may not contribute in a face-to-face environment.

The following webinars were organised by the ISE team in Ireland between February and April 2014.

- April 17th. Webinar - How to assess Science teaching using IBL strategies.

- April 14th. Webinar - Writing and Implementing ISE narratives. Addressing issues relevant to the individual contexts.

- April 9th. Webinar - In-depth working knowledge of LoggerPro aligned with school curriculum followed by Q & A session.

- April 8th. Webinar - Further support to teaching on the use of ISE narratives with implementation strategies and advice.

- April 1st. Webinar introduction to narratives of Inquiry Based Learning for educators with Marian Lowry from the Masters in Education and Training Management (eLearning) programme.

- March 25th. Webinar on IBL for educators with Scott Crombie from the Masters in Education and Training Management (eLearning) programme introducing IBL.

- March 18th. Webinar on digital tools for the classroom with Vernier Europe (http://www.vernier.com) representative Vincent English presenting on software tools.

- February 27th. Webinar to 21 post-primary schools on Erasmus+ http://ec.europa.eu/programmes/erasmus-plus/index_en.htm) mobility funding for e-Learning and Inquiry courses with contribution from Leargas.

- February 21st. Welcome Webinar and introduction of 21 post-primary schools (Pilot schools) to the ISE project. Introduction of ISE objectives, benefits, responsibilities, upcoming workshops - online and class based and funding opportunities

III. Methodology and structure of CPD course

Action research was the chosen research approach used to test out the use of an IBL approach with narrative templates. Using action research to test new teaching techniques such as IBL should help teachers to evaluate the results of new, innovative methods. Action research is a continual set of spirals consisting of reflection and action. Action research is a series of action-reflection cycles, where a teacher examines their practice, identifies an area for improvement, formulates a resolution, evaluates the outcome and if not satisfied repeats the process (McNiff 2010) [14]. According to Dick (1999) [15], 'informed by understanding, the action provides change. Out of the attempt to produce change, a greater understanding emerges' (p5).

The action research began with a review of current science practice so as to identify, ‘a state of affairs or situation one wishes to change or improve on’ (Elliott 1991, p72) [16]. A reconnaissance phase allows the teacher to explore the classroom issue they want to improve. This involves a realisation of the problem and plans are made for intervention. The intervention stage is monitored through rigorous data collection and analysis. This is followed by reflection on the data and if necessary revising the original plan. This revised plan incorporates changes to ‘improve the situation’ (Elliott 1991 p75). In conclusion, this means that if a cycle has been implemented, there should be a reflective and re-planning process. An educational entrepreneurial approach to action research was used which followed four key stages: Exploration, Understanding, Creating, Transforming (Crotty, 2014) [17]. The action reflection cycles of plan, act, observe and reflect are still integral to the approach,

A pilot group consisting of 21 science teachers from post-primary schools in Ireland agreed to participate in the ISE project. A practicing science teacher in a post-primary school in Ireland was invited to facilitate the webinars on IBL and ISE narratives. An ISE narrative is a story that describes a sequence of five learning activities, triggered by teacher and student actions, combined with the use of eLearning tools (Fig. 1). A narratives is designed to support students as they develop an inquiry based approach, formulate questions and hypotheses, gather and evaluate evidence, conduct investigations, analyse data and communicate their findings with other students and their teacher.

Figure 1.1: The Inspiring Science Education (ISE) narrative template.

Learning activity	Tool	Teaching & learning activities specified by instructional setting			Narrative
		Whole class	Small groups	Individually	
Orienting & Asking questions					
Hypothesis generation & Design					
Planning & Investigation					
Analysis & Interpretation					
Conclusion & Evaluation					

Fig. 1. The ISE Narrative template

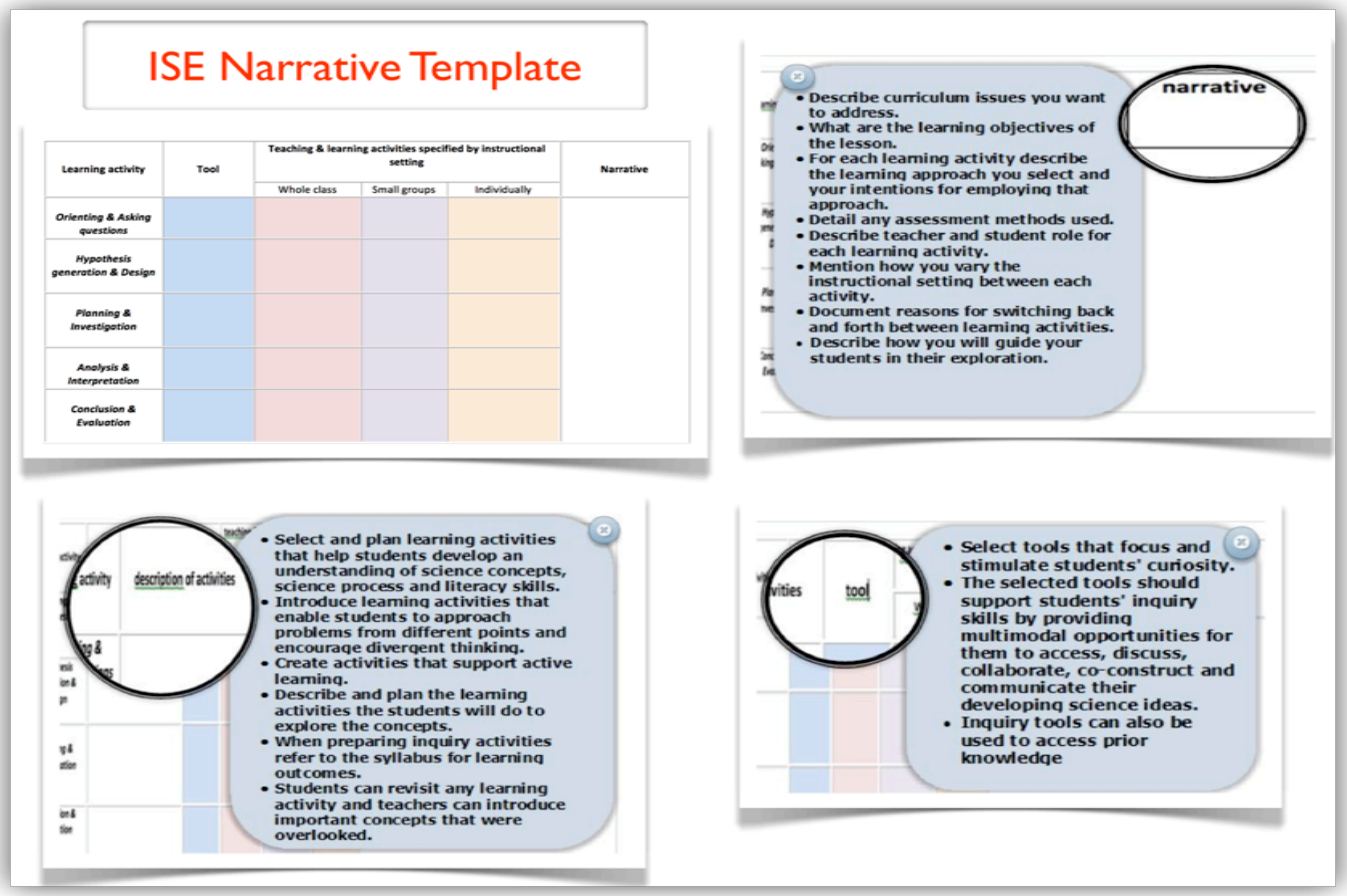

Fig. 2. Detailed description of ISE Narrative template

This simple planning strategy helps guide effective teaching by providing a model for a traditional teacher to follow as they develop the skills and confidence to teach IBL. In addition, this approach provides a means of guiding teachers as they facilitate a student-centered, technology-rich classroom by walking them through the implementation of the inquiry based lesson. With a clear formulated learning outcome, the teacher can plan their lesson using the ISE narrative template to identify the best way to reach that outcome. The narratives help teachers guide the student's learning and inquiry process as they select, design and plan learning activities.

IV. Monitor the Implementation of the Webinar

The first cycle of research involved supporting a practicing teacher to compose a set of narratives about implementing a Junior Science IBL lesson using the ISE narrative template. The first inquiry narrative enacted in the classroom by the practicing teacher was on the subject of Mass and Weight. This first cycle focused on examining the learning experience as the teacher composed and implemented IBL with eTools using the ISE narrative template in her own classroom. The teacher discussed how ISE narratives helped her to organise inquiry activities, highlight areas of focus, experiment with different ideas, and set realistic goals for student achievement. It made her realise how important it is to complete each lesson with a feedback and reflection session. The experience of authoring narratives with appropriate eLearning tools enabled the teacher to enact ISE narratives in practice to enhance students' interest and understanding of science.

In the second cycle, the focus was on sharing the experiences of implementing ISE narratives with other science teachers, with the intention of inspiring them to adopt IBL, narratives and eTools into their practice (Fig.3). The teacher was taught how to use the webinar tool Adobe Connect in order to facilitate the online webinars. The three main areas that the teacher had to consider in advance of the second cycle were on content, pedagogy and technology. The teacher realised the importance of presenting information on IBL and ISE narratives that would improve teachers IBL knowledge, build on their existing ideas and experience and address their needs. The plan was to situate the design of the webinars in the realities of classroom practice. The presentation was to detail the teacher's personal experience and her students' learning experience as they progressed through the five ISE learning activities.

The pilot group was informed of the intended peer based webinars on ISE narratives. The first webinar on narratives took place on 1st April followed by a second webinar on the 8th April and a final webinar on 14th April 2014. The webinars were effective at disseminating relevant and timely information on ISE narratives and eLearning tools to participating teachers. The content of the webinars on ISE narratives provoked interest while at the same time providing an opportunity for teachers to take part in open dialogue with other participating teachers.

Fig. 3. ISE Webinar session with Marian Lowry.

Nine narratives were created by the participating teachers. Each of the narratives were based on a topic in the Junior Certificate Examination and included topics such as Ohm's law, the circulatory system, food and digestion, energy in food, acids and bases, transpiration, pressure and atomic structures. The narratives were judged on the criteria/rubric in Table 1. These included introduction to the content, use of eTools and resources, a description of the role of the teacher, student's role detailed, description of learning activities, assessment methods, feedback to students described, learner objectives clearly stated, description of the instructional setting given, the application to real life, scientific process skills addressed, relevance to science syllabus provided, scientific content addressed, class conclusion provided.

Each criterion in the rubric was marked out of five. As you can see from the table, some teachers found it difficult to conclude the lesson with appropriate reflection and class discussions on goals achieved and lesson learnt. Some narratives failed to illustrate completely the inquiry process and learning. In addition teachers found it difficult to assess the inquiry process and provide scope for student to validate their learning process. However, these completed narratives provided evidence that the webinars were successful in extending the reach of our experience using ISE narratives and eLearning tools to other science teachers. The webinars allowed for the interchange of ideas and the resolution of issues. In future webinars it is important to include how assessment contributes to effective IBL when aligned with learning goals and inquiry based activities.

TABLE 1. NARRATIVE RUBRIC.

Narrative	Pressure	Ohms Law	Heart	Energy	Ohms Law	Transpiration	Acids & Bases	Atomic Structure	Food & Energy
Criteria									
Content introduction	2	5	5	4	5	2	2	4	5
Use of e-tools and resources	5	5	4	5	5	5	4	2	5
Teacher's role described	1	2	4	4	5	5	3	1	5
Student's role detailed	5	5	5	5	3	5	3	1	5
Description of learning activities	2	5	5	3	5	5	1	2	0
Assessment methods included	1	1	1	1	3	3	1	1	4
Students' feedback described	3	4	4	3	5	3	3	2	4
Learning objectives clearly stated	5	5	5	5	5	5	4	5	5
Description of instructional setting	4	5	5	4	3	5	3	3	5
Application to real life	0	5	5	0	0	5	5	0	5
Scientific process skills addressed	5	5	5	4	5	5	5	3	5
Relevance to science syllabus	5	5	5	5	5	5	5	5	5
Scientific content addressed	5	5	5	5	5	5	5	5	5
Conclusion of class	3	3	4	5	5	3	0	3	5
Total	46	60	62	53	59	61	44	37	63

V. CONCLUSION

The webinars enabled a democratic approach that empowered teachers to share and build on each other's experience. The webinars allows the interchange of ideas and the resolution of issues. In addition webinars facilitated social interaction by enabling real time dialogue with participating teachers.

The decision of the ISE team to involve practicing teachers in the facilitation of the webinars meant that teachers could identify more with fellow teachers; and pay more attention to their 'real life' learning experiences and 'what works for them'. An intimate and professional connection is automatically created between fellow professionals as opposed to a source who is not in the field delivering the message. A fellow teacher will have empathy for the teaching group he/she is addressing; people respond well to empathy and subsequently become more open to what the speaker has to say. These positive outcomes are harder for an outside expert to engender. It is recognised that one-shot modes of CPD courses presented by 'outside' experts have little relevance to the realities of the classroom or effectiveness in changing teachers' behaviour towards IBL. Often the content of these courses are divorced from the realities of the classroom. Without the motivation for CPD, experienced teachers instead of experiencing an incremental development of professional skills and knowledge will just continue to repeat the same yearly habits. CPDs need to solidify good practice, by empowering teachers to find and exploit existing eLearning tools and resources that are suitable to their practice and their students learning outcomes.

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