

An investigation into the use of an undergraduate journal club as an engagement tool to encourage students' interaction with scientific literature.

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Abstract

The purpose of this action research study was to investigate the use of an undergraduate journal club as an engagement tool to encourage/facilitate students' interaction with primary scientific literature. Engagement with science literature is a required graduate attribute that is necessitated by the QQI science award standards.

The research cohort in this study, were nineteen undergraduate final year students of a level 8 honours degree in Bioanalytical Science. They participated in a voluntary journal club that ran over a five week period as part of a ten credit module in Molecular Biology. Pre- and post-journal club survey questionnaires, along with interviews were used as instruments for qualitative data collection and analysed using thematic and descriptive data analysis. Fourteen participants completed pre-journal club survey questionnaires, while nine completed these post-journal club. Three participants made themselves available for post-journal club interviews.

Students' reported increased engagement in accessing, and time spent with, recommended essential reading text book, peer reviewed journal articles and science specific websites post-journal club. A supplementary finding was that students' perceived increased confidence in sourcing and appropriately using peer reviewed articles in their work but also with respect to speaking about these articles to their peers and the general public.

These findings corroborates other published research in the use of journal club as a tool to engage student with relevant subject-specific literature and as a tool for critical analysis and lifelong learning. Recommendations for future work would include a second research action model cycle with consideration of a weighted assignment brief that allows for summative marking.

Table of Contents

Section One: Rationale and Introduction	1
2.0 Literature Review and Critique.....	5
2.1 Drivers of student engagement in Higher Education	5
2.1.1 North American drivers of student engagement in HE	5
2.1.2 Australian drivers of student engagement in HE.....	6
2.1.3 European and the United Kingdoms’ drivers of student engagement in HE.....	6
2.1.4 Irelands’ drivers of student engagement in HE	6
2.2 Student Engagement.....	8
2.3 Journal Clubs and their use in educational research	10
2.3.1 Journal Clubs in Medical education	11
2.3.2 Journal Clubs in Nursing education.....	11
2.3.3 Journal Clubs in Science education	12
2.3.4 Methodologies employed in research using Journal Clubs as a research tool.....	13
2.4 Concluding Remarks	15
Section Three: Implementation and Evaluation.....	16
3.1 Research Aims and Objectives.....	16
3.1.1 Enhancement of student learning	16
3.1.2 Meeting the Institutional Need	17
3.1.3 Journal Club.....	17
3.2 Ethical Approval	18
3.3 Implementation.....	19
3.4 Research Methodology.....	21
3.4.1 Research Philosophy.....	21
3.4.2 Research approach and strategy	23
3.4.2.1 Action Research	24
3.4.2.1.1 Reflection in Action Research.....	25

3.4.2.2 Questionnaires.....	26
3.4.2.2.1 Piloting of questionnaire	26
3.4.2.3 Interviews.....	27
3.4.3 Data Analysis.....	27
3.4.3.1 Validity and reliability	27
3.4.3.2 Qualitative Analysis.....	29
3.4.4 Conclusion to Research Methodology.....	29
3.5 Evaluation of Research Study	30
3.5.1 Observation.....	30
3.5.2 Plan	31
3.5.3 Act	33
3.5.4 Reflection with Discussion.....	34
3.5.4.1 Research Outcome #1: To ascertain if undergraduate science students are engaging with science literature.....	37
3.5.4.2 Research Outcome #2: To appraise if participation in an undergraduate journal club increases students' perception of engagement with science literature.....	41
3.5.4.3 Research Outcome #3: To evaluate if participants of an undergraduate journal club perceive enhancement of their learning experience in undergraduate science	46
3.5.4.4 Concluding thoughts on 'Reflection with Discussion'	48
Section Four: Conclusion and Recommendations	52
4.1 Conclusion.....	52
4.2 Recommendations for future use of Journal Clubs in undergraduate science programmes.....	53
References.....	54
Appendices.....	71
Appendix 1	72
Appendix 2	90
Appendix 3	94

Appendix 4	97
Appendix 5	99
Appendix 6	102
Appendix 7	116
Appendix 8	126
Appendix 9	129
Appendix 10	131
Appendix 11	134
Appendix 12	137

List of Figures

Figure 3.1: Saunders 'Research Onion' as procured from Saunders et al., (2012).

Figure 3.2. Students' choices of how to access the recommended essential reading text books for Molecular Biology pre-journal club intervention study (Descriptive data from Question 4 pre-journal club survey questionnaire see Appendix 10).

Figure 3.3. Students' perception of how much support and training they received through the School of Science in using routes of access to source scientific literature pre-journal club intervention study (Descriptive data from Question 9a, b, c and d, pre-journal club survey questionnaire see Appendix 11).

Figure 3.4 Students' perception of how they rated their experiences accessing different types of scientific literature pre- and post- journal club intervention study (Descriptive data from Question 10a, b, c and d, pre-journal club and post- journal club survey questionnaire see Appendix 12).

Figure 3.5. Students' perception of how much time they spent interacting with different types of scientific literature pre- and post- journal club intervention study (Descriptive data from Question 11a, b, c and d, pre-journal club and post- journal club survey questionnaire see Appendix 12).

Figure 3.6. Students' rating of their confidence and ability to access, use and communicate a specific type of scientific literature, peer reviewed journal articles, pre- and post- journal club intervention study (Descriptive data from Question 12a, b, c and d, pre-journal club and post-journal club survey questionnaire see Appendix 12).

Figure 9A.1 Access to essential reading and sourcing of peer reviewed literature pre- and post-journal club (Question 3 and 6)

Figure 9A.2 Students chosen route of access to essential reading text books pre- and post-journal club (Question 4)

List of Tables

Table 3.1: Analogous layers of ‘Research Onion’ used to inform research undertaken in this study.

Table 3.2: Data collection methods employed to address each research objective for undertaken study.

Table 3.3: Planned structure of journal club delivery and format for research study.

Table 3.4: Actual structure of journal club delivery and format for research study.

Table 3.5: Comparison by gender of completion rates of documentation associated with data collection for research study.

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Section One: Rationale and Introduction

This research study looks to investigate students' engagement with scientific literature and whether the use of a journal club, at undergraduate level, facilitates enhanced engagement.

Student engagement, its role and contribution to higher education (HE) is the focus of numerous studies which have informed educational policy within many countries (Harper and Quaye, 2009; Yorke, 2014; Kahn, 2013; Kahu, 2013; Trowler, 2010; Department of Business, Innovation & Skills, 2011; Krause and Armitage, 2014; Department of Education, Employment and Workplace Relations, 2011; Dept. of Education and Skills, 2011; Case and Huisman, 2016). In Ireland, The National Strategy for Higher Education or as it is commonly referred to 'The Hunt Report', has enshrined student engagement in one of its six Higher Level System Objectives (HLSO) (Dept. of Education and Skills, 2011). The third HLSO of the strategy 'Excellence in Teaching and Learning to underpin a high quality student experience', has seen the formation and roll out of the Irish Survey of Student Engagement (ISSE). This survey was trialled in 2013 and rolled out across all HE institutes in Ireland in 2014. The study evaluates students' engagement across a wide spectrum of areas. However, engagement itself is seen by ISSE as 'important to facilitate in students the ability to develop key capabilities such as critical thinking, problem-solving, writing skills, teamwork and communication skills' (Studentsurvey.ie, 2016).

In July 2014, the Quality and Qualifications Ireland (QQI) released an updated awards standards document for the design of science programmes. It is clearly stated in all of the three learning outcomes of knowledge, skill and competence, that the learners (students) have to engage with original literature and should have the ability to communicate this scientific information in a variety of forms to specialist and non-specialist audiences (QQI, 2014).

Journal club has been defined in medical educational contexts as 'as any group of interested individuals meeting regularly to discuss the strengths, weaknesses, and clinical application of selected articles from the literature' (Lee et al., 2005 cited in Fowler, et al., 2011). Journal clubs are an internationally recognised and established teaching tool for postgraduate medical students (Alam and Jawaid, 2009, Pato et al., 2013 and Sabaretnam et al., 2014) and recently as a tool for collaborative learning in nursing education (Laaksonen et al., 2013, Baker, 2013 and Davis et al., 2014). Journal clubs, used as a teaching tool, can address both ISSE's and QQI's agendas of student engagement with original literature and presentation of such by

organised engagement of students with this literature and the communication of their findings to their peers.

Different types of scientific literature exist, normally referred to as the primary, secondary, tertiary and grey literature (Schembri, 2007). Primary literature refers to accounts of research carried out personally by an individual scientist or as collaboration by a group of scientists, which is published in a peer-reviewed scientific journal while secondary includes review journals, monographic books and textbooks, handbooks and manuals. Saunders et al., (2012), who was recommended by this programme for his book *Research Methods for Business Students*, divides literature into three categories, primary, secondary and tertiary, with secondary including books and peer reviewed literature. For the purposes of this research study, Saunders secondary literature sources will be demarcated as primary sources and primary scientific literature will include peer reviewed literature, books, subject specific websites and blogs.

The research to be undertaken in this study is framed within the context of both the above ISSE and QQI students' engagement agendas. In the research proposed for this study, undergraduate science students' engagement with primary scientific literature, as defined above, through the medium of a journal club will be evaluated.

With respect to science education, journal clubs are used to promote 'area' expertise and awareness at post graduate level where often journal club is part of the educational programme attached to doctoral research programmes. However, the use of journal clubs at undergraduate level in science has not been routinely reported through academic papers. Rauschert et al., (2011) reported on a workshop they provided to educators on how to incorporate primary literature into undergraduate curriculum after the publication of the American Association for the Advancement of Science (AAAS) paper in 2011. This AAAS paper is in part reflective of the QQI award standards and suggests that science students, in addition to learning content, need other core competencies or skills to become successful scientists (AAAS, 2011). All stated competencies can be addressed by using primary literature in a classroom setting, whether these skills are facilitated by journal club at undergraduate level is the subject of this investigation.

Through personal experience of lecturing undergraduate science students (who formed the research cohort), my perception was that they showed deficiency in their engagement with subject specific literature. The students' interaction with recommended reading lists and peer reviewed papers on their subject area was observed to be minimal. The research study proposes to investigate if a journal club is an appropriate and useful teaching tool for undergraduate science students and by its use, does it increase students perception of engagement with primary literature and address the perceived deficiencies.

Final year students undertaking a level 8, B.Sc. in Bioanalytical Sciences will be chosen as the research cohort. These students are in their fourth and final academic year of science study, many already having attained level 7 ordinary degrees in cognitive areas, and will be expected to have a good understanding of science literature and its use in both educational and non-educational settings. They will be asked to voluntarily participate in a journal club as part of their instruction, by myself, during a ten credit module in Molecular Biology. As no formal methodology to assess knowledge acquisition from undergraduate journal clubs has been found, the researcher proposes to work within an Action Research framework (Masters, 1995). Participating students will firstly decide on topics to be addressed within the journal club by looking at the learning outcomes and content found in the Module Descriptor. They will self-select in to groups of two to three students and will randomly be assigned one of the above chosen topics for presentation. They will then undertake to independently research and procure a peer reviewed paper in the topic and present it to the class group. This activity will have no formal weighting or grading attached to it and its sole purpose is an aid to learning without formal assessment. All students will be asked to complete the same questionnaire prior to, and post, engagement with journal club and to participate in concluding interviews to allow for substantiation of any found insights. From these questionnaires, information garnered will be examined to see if student's perceived an increase in their engagement and use of primary literature as a result of this intervention.

Skills, other than specialised knowledge in the students' subject areas, are expected to be achieved during a students' academic career (QQI, 2014) and carried forward into their future livelihoods. These include communication skills, critical thinking and learning strategies to support the concept of lifelong learners. Participation in a journal club setting, at undergraduate level, can support the assimilation and conception of these 'softer' transferable skills as well

as engagement with scientific literature. The research study has been demarcated into a further three sections; literature review and critique, implementation and evaluation and conclusion. The themes that informed the research study are further analysed in the literature review, while the chosen research methodology and its findings are elucidated in the implementation and evaluation section. Concluding arguments with recommendations are set out in the final conclusion section.

2.0 Literature Review and Critique

In the research proposed for this study, undergraduate science students' engagement with primary literature, through the medium of a journal club, will be appraised. The multifaceted framework of policy, research and opinion that informs the above research study will be highlighted within this review. Student engagement and the drivers of such are evaluated while methodologies employed to ascertain student engagement are addressed. The use of journal clubs as a form of student engagement in different areas, within different educational settings, are highlighted and all aspects are viewed through the lens of the researchers own practice.

2.1 Drivers of student engagement in Higher Education

The landscape of Higher Education (HE) in Ireland has been informed from educational research undertaken in North America, Australasia, Europe and our nearest neighbours the United Kingdom. Student engagement, its role and contribution to higher education, is the focus of numerous studies which have informed educational policy within these regions (Harper and Quaye, 2009; Yorke, 2014; Kahn, 2013; Kahu, 2013; Trowler, 2010; Department of Business, Innovation & Skills, 2011; Krause and Armitage, 2014; Department of Education, Employment and Workplace Relations, 2011; Dept. of Education and Skills, 2011; Case and Huisman, 2016). These international studies and their key findings are discoursed in further detail below.

2.1.1 North American drivers of student engagement in HE

Harper and Quaye (2009) looked at student engagement with HE in a North American setting. In comparison to Ireland, North America has a very diverse learning population and this book looks at theoretical perspectives and practical approaches to engage this diversity. Bensimon (2009) writes in the forward of this book that 'productive engagement is an important means by which students develop feelings about their peers, professors, and institutions that give them a sense of connectedness, affiliation and belonging, while simultaneously offering rich opportunities for learning and development' (Harper and Quaye 2009, p.xxii) . She stated in order for this to occur 'students must invest time and effort into academic activities and practices...that correlate highly with positive educational outcomes' (Harper and Quaye, 2009, p.xxiii). The development of The National Survey of Student Engagement (NSSE) saw a survey mechanism used to measure the level of student participation at universities and colleges

in this diverse setting of North America (Kuh, 2001, 2003 & 2009; Nsse.indiana.edu, 2016) and is used internationally to inform and support research within the area of student engagement. Findings from the NSSE in relation to student engagement has been reported widely (National Survey of Student Engagement, 2012) and used to inform government policy on education both in the United States (Commission on the Future of Higher Education, 2006) and internationally (Department of Business, Innovation & Skills, 2011; Department of Education, Employment and Workplace Relations, 2011; Dept. of Education and Skills, 2011)

2.1.2 Australian drivers of student engagement in HE

In Australia, Krause and Armitage, (2014) compiled an overview of published literature on student engagement in Australia over the past 20 years. Australia has a long history of surveying students engagement with Course Experience Questionnaire use since 1992 as part of the Australian Graduate Survey (Henman & Phan, 2014) and the Australasian Survey of Student Engagement (AUSSE) since 2007 which is managed by the Australian Council for Educational Research (Acer.edu.au., 2016). Both of the above student engagement surveys informed government policy in Australia (Department of Education, Employment and Workplace Relations, 2011).

2.1.3 European and the United Kingdoms' drivers of student engagement in HE

In 2015, the Council of Europe Higher Education Series looked at student engagement in Europe as a whole and focused on three parameters: its role in society through political participation and civic involvement; its place in higher education policy processes and policy-making structures; and how student unions represent the most institutionalised form of student engagement (Bergan, et al., 2015). The Netherlands carry out an annual survey that asks its higher education students to assess their learning experiences (Students | Universiteit Utrecht, 2015). In the United Kingdom (UK), since 2005, student engagement is also determined by the annual student survey (Ipsos-mori.com, 2016). This survey had informed government policy (Department of Business, Innovation & Skills, 2011) and it, along with its international counterparts, has provided the scaffold for the Irish HE landscape on student engagement and related government policies.

2.1.4 Irelands' drivers of student engagement in HE

The National Strategy for Higher Education, has enshrined student engagement within one of its six Higher Level System Objectives (HLSO) (Dept. of Education and Skills, 2011). From this National Strategy, a System Performance Framework, stating national priorities and key

objectives of the Irish Government for HE was set out by the Minister for Education and Skills for 2014-2016 (Department of Education and Skills, 2013). This laid the foundation for the creation of the Irish Survey of Student Engagement (ISSE). This survey evaluates students' engagement across a wide spectrum of areas. Engagement is seen by ISSE as 'important to facilitate in students the ability to develop key capabilities such as critical thinking, problem-solving, writing skills, teamwork and communication skills' (Studentsurvey.ie, 2016).

Echoic of its international counterparts, Ireland's HE landscape and focus has changed dramatically over the last decade. However, there appears to be a changing focus driving the HE landscape both in the UK (Thomas, 2012) and Ireland (Lynch et al., 2012; Doring, 2002). It is one where policy changes are shifting the responsibility for funding for HE away from the government and its' tax payers and towards the deliverers of HE and their students. Student engagement has now, due to national drivers, become a measurable target for budget allocation for providers of HE and the ISSE has been perceived by many as a potential instrument to measure this engagement.

Collins (2007) has charged the Irish government of embracing new public service management from the 1990s onwards as a mode of governance to promote neo-liberal economic and social policies. Within education, new managerialism redefined what counts as knowledge, who are the bearers of such knowledge and who is empowered to act – all within a legitimate framework of public choice and market accountability (Olssen and Peters, 2005).

The National Strategy for Higher Education (Dept. of Education and Skills, 2011) is focused on efficiency, flexibility and accountability, all facets of the new managerialism agenda. The strategy and its six Higher Level System Objectives are now framing the future of Irish HE as it is currently being implemented by the Higher Education Authority (HEA). This policy has permitted the undermining of autonomy within Higher Education Institutes by ensuring that 'institutional strategies will be defined and aligned with national priorities' (Dept. of Education and Skills, 2011, p14) and as such funding for HE providers are now tied to Institutional compacts and delivery of their goals. This has ensured that changes over the last decade in Irish HE are now being driven by a change from being viewed as centres of learning to business organisations with productivity targets and changing their allegiance from academic to operational as envisioned by Doring (2002). The HEA has instigated an environment where the focus in education is on measurable outputs. The OCED review of HE in 2004 (OCED,

2004), that predated The National Strategy for Higher Education, emphasised the role of HE in developing a ‘skilled workforce for the economy’. It did not include any details on the role of HE in developing the civil, political, social or cultural institutions of society. The delivers of HE in Ireland are moving from under the control of the church in the 1950’s to being increasingly shaped by a neo-liberal state, to a substantive degree through market related processes (O’ Sullivan, 2005).

As student engagement has become a measurable target for budget allocation for providers of HE it is now also being championed at institutional strategy level. Letterkenny Institute of Technology (Lyit) has placed student engagement as a core strategic growth point in its new Institutional strategy (Letterkenny Institute of Technology, 2014) with student experience as a stand-alone strategic domain. The Institute has given great weighting to their relationship with the student body at Lyit and as part of its mission based performance compact between itself and the HEA it has created measurable outputs with respect to student experience and engagement using ISSE as a performance indicator (HEA, 2014). ‘LYIT is determined to build on the excellent relationship that we enjoy with our student body by working collaboratively with students on all aspects of student services and campus facilities to contribute towards an improved student experience.’ (Letterkenny Institute of Technology, 2014). Student engagement and its measurement looks to have a sustained focus within Lyit.

2.2 Student Engagement

With student engagement enshrined in the policy documents that governs HE in Ireland, within this context, what exactly does student engagement entail and how is it measured? There are many definitions of student engagement. Student engagement was primarily defined in the 1980’s by the amount of time students spent on their academic endeavours (Brophy, 1983; McIntyre, et al., 1983). At present, Kuh (2003), and Coates (2005) research into engagement of students in North America and Australia respectively, seems to inform the definitions that most educational policies are built upon i.e. ‘the time and energy students devote to educationally sound activities inside and outside of the classroom, and the policies and practices that institutions use to induce students to take part in these activities’ (Kuh, 2003). Trowler (2010) carried out an important review on the literature published around student engagement on behalf the Higher Education Academy in the UK and provides a more in-depth analysis of the term, drawing on international literature ‘Student engagement is concerned with the interaction between the time, effort and other relevant resources invested by both students and

their institutions intended to optimise the student experience and enhance the learning outcomes and development of students and the performance, and reputation of the institution.’ Trowler (2010, p.3) while Mandernech (2015, p.2) reports that the ‘range of definitions for student engagement converges to emphasize three interrelated aspects of student engagement: cognitive, behavioral, and affective’. Trowler (2010) carried out an extensive review on the literature published around student engagement on behalf the Higher Education Academy in the UK.

Similarly, ISSE defines engagement ‘as students’ involvement in activities and environments that are likely to generate high-quality learning’ (Studentsurvey.ie, 2016). It interprets students’ answers through two indices, engagement and outcomes. The engagement indices include: Academic Challenge, Active Learning, Student - Staff Interactions, Enriching Educational Experiences, Supportive Learning Environment and Work Integrated Learning. While the outcomes indices are: Higher Order Thinking, General Learning Outcomes, General Development Outcomes, Career Readiness and Overall Satisfaction (Irish Survey of Student Engagement (ISSE), 2015).

The context of engagement, as related to this study, is in the quality of, and time spent, engaging with subject specific literature, specifically peer reviewed journals. As such, this engagement, in the form of a journal club, can be embedded in all three aspects of cognitive, (the extent to which students are attending to and expending mental effort in the learning tasks encountered) behavioural (the extent to which students are making active responses to the learning tasks presented) and affective (the level of students’ investment in, and their emotional reactions to, the learning tasks) engagement (Chapman, 2003; Handelsman et al., 2005). The research study that is to be undertaken can also be framed within Bowen’s (2005) experiential learning classification (engagement with the object of study) of student engagement. Trowler (2010) looks at student engagement with respect to what the targets of engagement are, and the purpose of this engagement in the HE environment. Trowler (2010) delineates targets of student engagement into five different areas: specific student learning aspects/processes, learning design, tools for online/classroom-based learning, extra-curricular activities and institutional governance. This research study, using a journal club as a tool of engagement, will straddle both ‘Specific student learning aspects’ (Trowler, 2010, p.17) by looking at the students own perception of learning prior to and after the journal club and ‘Tools for classroom learning’ (Trowler, 2010, p.18) as the journal club

is a new classroom tool for this research cohort. The reason of this engagement is ‘to improve learning’ (Trowler, 2010, p.22) and this theory is widely supported in the literature (Coates, 2005; Brown et al., 2014; Sanders et al., 2011). With respect to the ISSE engagement rubrics, this research is bedded between both the engagement, specifically Academic Challenge, Active Learning and Supportive Learning Environment, and outcome indices, Higher Order Thinking and General Learning Outcomes.

This research study will look at students perception of their own engagement prior to and post involvement in an undergraduate journal club. The many definitions of student engagement have threads of commonality such as ‘learning’ but since there is a movement to metrics of this engagement, the definition of what students’ engagement is and how it is measured is a changeable feast depending on what the information is to be used for in future. The student engagement that is being researched in this study is framed above using different researchers and interested parties definitions of what student engagement actually entails. Trowler (2010) allows a mechanism to illustrate what type of engagement this research study is focusing upon but also the reason why it is being undertaken. ISSE highlights that this research study can add data to numerous metrics that it analyses with respect to student engagement.

As a measurable entity student engagement, in a national setting, is evaluated through ISSE, but in a research setting it is often measured within an Action Research context. The instrument of choice to look at student engagement with science literature in an action research cycle in this research study is a journal club.

2.3 Journal Clubs and their use in educational research

Journal clubs are an internationally recognised and established teaching tool for postgraduate medical students (Alam and Jawaid, 2009, Pato et al., 2013 and Sabaretnam et al., 2014) and recently as a tool for collaborative learning in nursing education (Laaksonen et al., 2013, Baker, 2013 and Davis et al., 2014). With respect to science education, journal clubs are used to promote ‘area’ expertise and awareness at post graduate level where often journal club is part of the educational programme attached to doctoral research programmes. However, the use of journal clubs at undergraduate level in science has not been routinely reported through academic papers. The research cohort targeted in this study are undergraduate science students, in their final year of a B.Sc. in Bioanalytical Science, and findings from this study should add to the limited knowledge there is available at present in this area.

2.3.1 Journal Clubs in Medical education

Many articles can be found in medical education on the role of journal clubs and their use in skills enhancement for postgraduate medical students. Hohmann and Tetsworth (2016) looked at critical appraisal of literature for postgraduate medical students through the uses of a journal clubs and found that over the course of ten weeks, when using a structured approach to the review and appraisal of journal articles critical reading skills were significantly improved. O'Sullivan et al., (2016) reviewed medical literature evaluation in schools of pharmacy in the United States and found that the use of active learning strategies were chosen using journal clubs as the main tool for delivery of this strategy. Findings reported by Sanchez-Mendiola et al., (2016) concur with those of Hohmann and Tetsworth in that within their research area, medical education, a periodic journal club can improve critical appraisal of primary literature.

Within postgraduate medical education, journal clubs and their use have been attributed to the enhancement of other skills apart from critical evaluation of primary literature. Serghi et al., (2015) reported that the use of journal clubs in postgraduate medical education are advantageous to the participants in that they are thought to include facilitating participants' development into lifelong learners; improving their fundamental knowledge and providing skills to form effective multidisciplinary relationships that enhance patient care. Other attributes that have been garnered from journal club participation have been reported as leadership skills (Kattan et al., 2014), increased knowledge sharing and mentoring opportunities (Bowen et al., 2014) and lifelong learning and maintenance of certification (Pato et al., 2013)

Journal clubs for postgraduate medical education have now progressed into the realms of virtual journal clubs (Lin and Sherbino, 2015; Sortedahl, 2012), twitter based journal clubs (Topf and Hiremath, 2015; Roberts et al., 2015) and on numerous other platforms within social media (Plante et al., 2015; Yang and Meals, 2014)

2.3.2 Journal Clubs in Nursing education

The use of journal clubs in nursing education is also well reported (Laaksonen et al., 2013, Baker, 2013 and Davis et al., 2014). Seymour et al., (2003) looked at changing the clinical nursing environment to enable critical and creative thinking through the use of journal clubs. Thompson (2006) reports the use of journal clubs as a teaching strategy for nursing education as an excellent way to raise research awareness, improve professional reading habits and

critiquing skills, and involving nursing students to prepare them for the expectation of evidence-based practice. Laaksonen et al., (2013) reported a descriptive study of a journal club used as a method for nurses and student nurses collaborative learning. They reported that student nurses experienced their competences to search, evaluate, and communicate scientific knowledge as improved and the collaboration with nurses to be advantageous. However, the students in this research cohort also experienced journal clubs as demanding and several developmental need were reported such as heavy workload, timing issues and the selected journal club topics.

Davis et al., (2014) while carrying out their research with postgraduate nursing students found that journal club facilitated an increase in student awareness and reading of nursing literature that enabled them to apply it to their nursing practice. Lachance (2014) reviewed published literature on nursing journal clubs and concluded that nursing journal clubs proved an effective teaching strategy. However, due to the self-motivated and voluntary nature of this teaching strategy, a limitation commonly identified in the primary literature was lack of participation.

Whiting (2015) researched the use of Journal club with undergraduate nursing students and his findings are reflective of those by Laaksonen et al., (2013). Although a very small research cohort was involved he found that Journal club was successful as an intervention to increase critical thinking skills and research appraisal.

Journal club, as a means to engage students and to measure certain criteria enhanced by this engagement, is well documented in both undergraduate and graduate medical and nursing education. Studies carried out using journal clubs within these educational settings will help inform the research being undertaken in this study using an undergraduate science research cohort.

2.3.3 Journal Clubs in Science education

With respect to undergraduate science education and the use of journal club as a teaching tool to evaluate any aspect of engagement, such as critical thinking or collaborative work studies undertaken and reported have been minimal. Rauschert et al., (2011) reported on a workshop they provided to educators on how to incorporate primary literature into undergraduate curriculum after the publication of the American Association for the Advancement of Science (AAAS) paper in 2011. This AAAS paper is in part reflective of the QQI award standards

(QQI, 2014) and suggests that biology students, in addition to learning content, need other core competencies or skills to become successful scientists (AAAS, 2011). McDonough (2012) used dialectical notes as a support to an undergraduate molecular biology journal club. In her reflection she suggested that the use of dialectical notes increased group discussion and focused the participants' engagement with primary literature. Sandefur and Gordy (2016) research illustrated that active learning based undergraduate journal clubs were a method to expose students to primary literature and improve their ability to apply the scientific process in a limited resourced educational environment. They framed this teaching intervention through the needs identified and highlighted in government and relevant governing bodies reports, which are reflective in nature of the QQI and HEA reports in Ireland. Like Sandefur and Gordy (2016) I support the idea that journal clubs, used as a teaching tool, can address both ISSE's and QQI's agendas of student engagement with original literature and presentation of such, by organised engagement of students with primary literature and the communication of their findings to their peers. Although Griffard et al., (2013) did not use journal clubs in their research they looked at the impact of the use of a science book club in understanding of the nature of science with undergraduate premedical students and found that participants showed a marginal improvement in their recognition of the nature of science. However, they also reported that the voluntary participants that the book club attracted were already self-motivated and that this may have affected the results reported. This result, although using a different research cohort, are reflective of those found when using nursing students as a research instrument, by Laaksonen et al., (2013) and Lachance (2014).

2.3.4 Methodologies employed in research using Journal Clubs as a research tool

The use of journal clubs has been predominantly at post graduate level and assessment of knowledge has been carried out mainly by informal means. In medical education, the creation of a Critically Appraisal Topic (CAT) is often the product of journal clubs which are uploaded onto databases for dissemination among like-minded researchers in the areas of their speciality, as in this case, obstetrics and gynaecology (Afifi et al., 2006). Use of structured review and checklists to guide students through the appraisal of primary literature is another methodology (Burnstein et al., 1996). An action research system was implemented by Davis et al., (2014) to assess integrating research awareness into postgraduate nurse training. Laaksonen et al., (2013) collected data by the use of semi-structured interviews using both quantitative and qualitative methods of analysis. Sabaretnam et al., (2014) included a journal club evaluation form in their paper entitled 'Journal Club in Endocrine Surgery'. The limited research into undergraduate

journal clubs showed use of action research strategies, underpinned by data collection methods of surveys, questionnaires and interviews using mixed methods of quantitative and qualitative analysis. Whiting (2015) adopted an interpretive action research strategy to gain perspective on the experience and impact of implementing a Journal club into an undergraduate nursing degree programme. He used focus groups and also short questionnaires pre- and post- journal club exposure and carried out simple statistical analysis of the descriptive data. McDonough (2012) used surveys to collect data and carried out statistical analysis on the result. Griffard et al., (2013) used an already established questionnaire and focus group interviews to collect data pre and post their book club intervention. They analysed these findings qualitatively, along with students summative exam marks to interpret their overall conclusions. Sandefur and Gordy (2016) used questionnaires pre- and post- journal club to collect their data and used qualitative methods of analysis.

Journal club has been used in medical, nursing or science educational settings for student engagement to support various educational outcomes. However, the majority of the literature findings reported above have surprisingly small research cohorts from which they have extrapolated statistical data. As a trained basic research scientist, small cohorts do not allow for credible statistical analysis, yet in medical education, Hohmann and Tetsworth (2016) reported statistical findings using 20 postgraduate medical students, Sánchez-Mendiola et al., (2015) using an average of 22 postgraduate medical students, Serghi et al., (2015) using 36 postgraduate students while Kattan et al., (2014) used 8 students and Burstein et al., (1996) used 18. Nursing and science education also used mainly descriptive statistical analysis with small research cohorts. Whiting (2015) had 7 post graduate nursing students in his research cohort, while McDonough (2012) had 18 undergraduate science students and Sandefur and Gordy (2016) had 12 participants. Most of these researchers researched with their own teaching cohorts and as such the use of small research cohorts can be understood. However, whether you can statistically analyse your findings and report p values is questionable. Laaksonen et al., (2013) and Davis et al., (2014) studies using journal clubs in nursing education are more credible as is Pato et al., (2013) in medical education. Laaksonen et al., (2013) used 216 nurses and 235 nursing students as his research cohort and reported positive findings of engagement using semi-structured questionnaires as his data collection tool. Davis et al., (2014) used an action research model using four cycles that was run over five academic years and as their data was collected using different research cohorts' validity and reliability is added by the repetition process. Pato et al., (2013) also looked at a longer time period using

research from a period of four years of journal club in a residency programme, each year having its own learning agenda. This research study will be limited by its cohort size as it is sourced directly from my own teaching cohort and is expected to be under twenty students and also in its repetition, as only a single snapshot using one cycle of an action research model will occur. However, the frequency of the journal club, weekly over a semester is reflective of research published to date in science education (Sandefur and Gordy, 2016; McDonough, 2012) and once again, this is due to researching using own students from your teaching portfolio. The frequency of journal club in medical and nursing education is more of a monthly rotation.

2.4 Concluding Remarks

The researcher proposes to work within an Action Research framework using the four stage cyclical Norton (2009) action research model. Data will be collected using questionnaires, pre- and post- journal club, with use of Likert and open ended type questions and supplemented with exit interviews. Mixed methods of analysis, both quantitative and qualitative, will be used to interpret and report findings. These methodologies will be described and explored in the next section.

This literature review has framed the research proposed within an Irish HE setting and substantiates the use of a journal club, as a tool to assess student engagement with primary literature, in an undergraduate science educational environment. Although not much research to date has been reported or published using journal clubs as tools for primary literature engagement by students in a science setting, the research envisioned for this study is supported and evidenced by complimentary research in other educational backgrounds.

Section Three: Implementation and Evaluation

3.1 Research Aims and Objectives

Research Aim

To investigate the use of an undergraduate journal club as an engagement tool to encourage/facilitate students' interaction with scientific literature.

Research Objectives:

1. To ascertain if undergraduate science students are engaging with science literature.
2. To appraise if participation in an undergraduate journal club increases students' perception of engagement with science literature.
3. To evaluate if participants of an undergraduate journal club perceive enhancement of their learning experience in undergraduate science.

3.1.1 Enhancement of student learning

QQI award standards for science have clear guidelines of what achievements or skillset students at different levels in science programmes should have upon completion of their awards (QQI, 2014). These awards standards have learning outcomes for three areas; Knowledge, Know-How and Skill, and Competence. Level 8 students, the research cohort used in this study, have specific indicators under each of the above learning outcomes that may be supported by participation in this research (QQI, 2014, p.7). Students of level 8 science programmes should be able to 'source, interpret and apply appropriate and referenced literature and other information sources' and 'present and engage in debate relating to general scientific issues' (QQI, 2014, p.4 and p. 5). Participation in a journal club will encourage these specific skills and may also initiate the development of skills to encourage lifelong learning. Students will have to source primary peer reviewed literature, interpret the findings and present these to their peers. They will also have to participate in a discussion after the presentation and answer questions on their findings. By encouraging students to engage with primary scientific literature and develop the necessary skills to research and locate this material, the ability to take this forward in their careers will be beneficial and contributory towards establishing the practice of lifelong learning.

3.1.2 Meeting the Institutional Need

Lyt are held to standards set by educational policies even if they have delegated authority. The HEA and QQI have substantial input into Lyt's Quality Assurance Handbook (Lyt, 2011). Lyt's quality assurance documentation was mandated by the Qualifications (Education and Training) Act 1999 and is informed by 'Assessment and Standards' Policies from QQI (2013). QQI also mandate the award standards for certain disciplines, with the publication of updated standards for science awards in 2014.

QQI award standards for science include clear guidelines that students at level 8 should have 'a detailed knowledge of advanced methods for acquiring, interpreting and analysing subject-specific information, with a critical understanding of the appropriate contexts for their use through the study of texts and original papers' and be able to 'to communicate scientific information in a variety of forms to specialist and nonspecialist audiences' (QQI, 2014, p.3 and p.4). Lyt adhere to QQI standards when designing programmes in science and as such it is part of their remit to ensure that graduates of their science programmes have the skillset and knowledge as demanded by QQI. By participation in a journal club, students will gain a better understanding on how to access, critique and present original papers and will augment their communication skills. This research will directly support the QQI guidelines for science and as such institutional need.

3.1.3 Journal Club

In the field of medicine and medical education, journal clubs, as a method to promote literature awareness is well documented where their general purpose is to facilitate the review of a specific research study and to discuss implications of the study for clinical practice (American Journal of Critical Care, 2002). From personal teaching practice and reflection, I became aware of a deficiency in engagement of undergraduate students with scientific literature, whether it was the recommended text book in earlier years or peer reviewed literature in later study. Having lectured in medical and post-graduate science educational settings, journal club was a weekly event that all attended. It was used in the sense defined above to inform clinical practice or disseminate new information on scientific findings in the cognitive areas of research that were being investigated. In this research study a journal club is trialled in an undergraduate science setting as a teaching tool to encourage engagement with peer reviewed primary scientific literature.

3.2 Ethical Approval

Ethical approval for this study was obtained from Lyit prior to its undertaking. Lyit ethics Policy and Procedures are available on line (Lyit, 2015a) and have been developed based upon the Declaration of Helsinki (World Medical Association, 2013) and EU Directive 2001/20EC on Clinical Trials. Researchers in Lyit are expected to conduct their research in line with best ethical practice and all research proposals have to be assessed and verified by the ethics committee prior to commencement. The ethics approval form submitted and approved by the Institute Research Ethics Committee, for this study is included in Appendix 1.

Prior to research commencement, all participants were given an information sheet in relation to the study and were asked to sign informed consent documentation see Appendix 3 and 4 respectively. Informed consent involves 'ensuring that the participant is provided with adequate information about the nature of the research, how it will be used and reported, its benefits, as well as potential harm that could arise from it, to enable them to decide whether or not to agree to take part' (Day Ashley, 2012 p.35).

Although there are no vulnerable groups involved in this research, such as persons under 18, people with learning difficulties, older people, there is an identified issue with respect to the research cohort, such that they came from the researchers own teaching classes. Comer (2009) has written about the ethics of using students from your own teaching rota and has voiced that special care should be exercised because of the unequal power relationship between students and faculty. Cognisant of this imbalance, participating students were explicitly informed that participation was not mandatory and that their choice would not impinge on any marks achieved in assessments that may be carried out within the assigned teaching module. They were also explicitly informed that they could remove themselves from this process at any stage without penalty. Details for the Head of Department of Law and Humanities, whom hosts this masters programme, were included in the information sheet provided to participants to allow transparency and a point of communication if clarification on any conflicting issues arose.

Saunders et al., (2012) write in detail regarding ethical issues surrounding collecting and processing data and storage of this material. The researcher worked within an action research framework to assess engagement of undergraduate students with journal club. Data collection was undertaken using questionnaire surveys and interviews and qualitative analysis was carried

out. All data gathered was stored securely so that data cannot be accessed, altered, disclosed or destroyed by unauthorised persons in accordance with best practice and with Lyit's policy on data protection and storage of electronic data (Lyt, 2015b). It can be accessed only by myself and upon request by my supervisor. The data was maintained on a password protected computer with password protected screen saver. The computer software is updated regularly by Lyit and it contains Norton Antivirus software which is set for daily automatic updating. In addition to the antivirus software, a firewall also runs on the computer. All documents were password protected. International best practice requires that all research data created should be stored for several years. The general recommendation is that there is secure retention of anonymised data for 5 years after the completion of the study, in line with Lyit's Guidelines for Electronic Data Storage (Lyt, 2015b)

3.3 Implementation

The research cohort, which were approached for inclusion in this study, were undergraduate final year students of a level 8 honours degree in Bioanalytical Science in the Department of Science in Lyit. Although these students have already completed a three year level 7 ordinary degree in either Bioscience or Analytical and Forensic Science, they are undertaking a one year add-on undergraduate level 8 programme. The research was undertaken as part of a ten credit module in Molecular Biology which I was delivering and is timetabled in semester one of the academic year. Molecular Biology has both a theoretical and practical element. There are four hours of contact each week for lectures and a weekly three hour laboratory practical. The module has a summative three hour final written examination that substantiates 60 per cent of the final overall mark. The practical laboratory element constitutes 30 per cent of the final marks and there is 10 per cent available for a formative piece of continuous assessment. The module descriptor for this is included in Appendix 2.

An academic semester in Lyit is structured in accordance to the Mod/Sem framework (Lyt, 2015c) consists of fifteen weeks, thirteen weeks of instruction with two weeks for summative examinations. The research study was originally designed to allow a weekly journal club over the course of the full academic semester, with one paper presented each week (Section 3.5.3: Table 3.3.). However, this did not occur as ethical approval was not obtained until week 8 of the academic semester. A revised format was planned were journal club would run over a five

week period, from week 9 to 13 of the academic semester and two papers would be presented at each journal club timeslot (Section 3.5.4: Table 3.4).

All nineteen students in the Bioanalytical Science programme attended an introductory session held during a Molecular Biology lecture hour in week eight of the academic semester where journal club was explained and what their participation would entail was clarified. Students were informed that there was no credit or percentage of final marks available for this commitment. They were explicitly informed that participation was voluntary and their choice would not impinge on any marks achieved in assessments that may be carried out by the myself within the Molecular Biology module. At this session, they were given an information sheet on the purpose and content of the research study and a consent form (Appendices 3 and 4). The cohort were asked to reflect on the session, read the information sheet given and sign the consent form if they would like to participate in the study. A two day grace period was allowed before submission of the consent forms to allow for discussion and reflection prior to commitment. All nineteen students signed consent forms and agreed to participate in the research study.

In the first session of the journal club in week nine, a preparatory session, all students present decided collectively on what subject areas of the Molecular Biology programme they would like supported by journal club. They decided on eight topics for discussion and to present in groups of two or three that were reflective of their practical laboratory groups. One of the eight chosen topics were randomly assigned to each group and they were tasked with finding a peer reviewed journal on this area from the last five years and then to take this forward for presentation and discussion at journal club. The chosen article was sent to me, a week prior to presentation, for uploading on the Virtual Learning Environment for this module so it could be accessed and read by all students prior to journal club. During this preparatory session, a structured review instrument tool to help students in analysing their chosen paper and preparing for presentation was also introduced to the research cohort. This tool, an article review form, was taken from the American Society of Parenteral and Enteral Nutrition (ASPEN) journal club kit (ASPEN, 2015). The first survey questionnaire was given to the research cohort during this session and was filled out during this time. Fourteen students filled out this questionnaire, a copy of which is located in Appendix 5.

The first presenting of primary literature within a journal club context did not occur until week 11. The journal club that was organised for week 10 was postponed due to presenters' absence due to medical reasons. Two journal clubs were held during week 11 and two during week 12 to facilitate completion during the academic semester.

On week 12, attendees of the final journal club were asked to complete the same survey questionnaire as previously filled on week 9. Nine students completed this second questionnaire. Raw data ascertained from both pre- and post- journal club questionnaires are located in Appendix 6

As mixed methods were chosen for used in this research to help validity and reliability of the research undertake, all nineteen students that filled consent forms were invited to partake in an interview process during week 13. All students were given the interview questions prior to the process to allow for equilibrium of the power balance as suggested by Comer (2009). Out of the nineteen voluntary consented students approached, three students volunteered and were interviewed. Transcripts of these interviews were anonymised and are located in Appendix 7.

3.4 Research Methodology

3.4.1 Research Philosophy

Research Philosophy relates to the development of knowledge and the nature of that knowledge (Saunders et al., 2012). Educational Research is the scientific field of study that examines education and learning processes and the human attributes, interactions, organisations and institutions that shape educational outcomes as defined by the American Educational Research Association (Aera.net, 2016). Having spent over 20 years being a scientific researcher, the undertaking of this research study saw a paradigm shift, where paradigm is defined as 'a loose collection of logically related assumptions, concepts or propositions that orient thinking and research' (Bogdan & Biklen, 1998, as cited in Mackenzie & Knip, 2006), in my philosophical approach to research. According to Saunders et al., (2012) and their 'Research Onion', I have moved from a previously held scientifically based Positivism philosophy to a Realism philosophy.

For this research study we have been directed to use Saunders 'Research Onion' (Saunders, et al., 2012), as an implement to formulate an effective methodology to investigate our research

objectives, see Figure 3.1 The ‘onion’ has six layers and one moves from the outer layer of philosophies to the inner layer of techniques and procedures. The outer layer of the ‘Research Onion’ lists the scientific paradigms into four categories: positivism, realism, interpretivism and pragmatism. However, the Research Onion diagram excludes the three philosophies of Ontology, Epistemology and Axiology. Ontological philosophy is concerned with the nature of reality. It requires researchers to ask themselves how they think the world operates, how society is constructed and how this influences everything around us (Crotty, 1998; Cohen et al., 2003). Epistemology focuses on the origins and nature of knowing, the construction of knowledge and the relationship between the knower and the known (Maykut & Morehouse, 1994). Axiology allows the researcher to understand and recognize the role their values and opinion play in the collection and analysis of the research as opposed to eliminating or trying to balance the influence of it (Heron & Reason, 1997). Healy and Perry (2000) concur with above excluded philosophies of Ontology and Epistemology but also include another, Methodology, the technique used by educational researchers to investigate their Ontology.

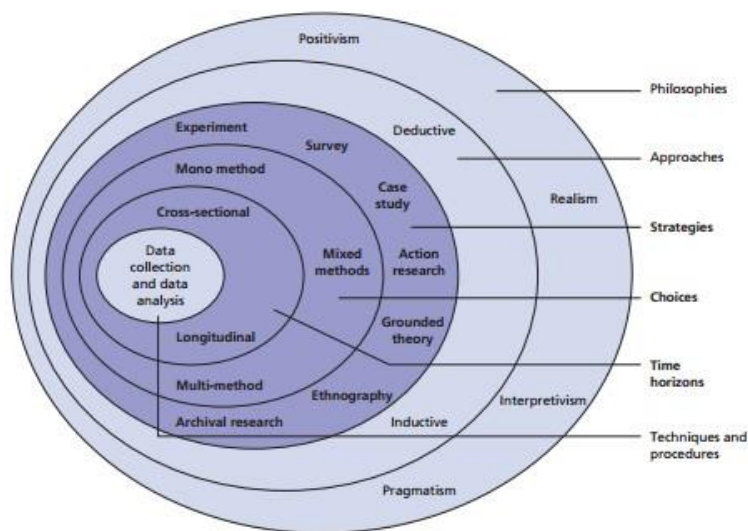


Figure 3.1: Saunders ‘Research Onion’ as procured from Saunders et al., (2012)

Progression through the ‘Research Onion’ layers for this study and its findings is shown in Table 3.1. I have taken a Realist stance to investigate this research. Realism is similar to positivism, however realism believes that scientific methods are not perfect and all theory can be revised. Realists believe that ‘our ability to know for certain what reality is may not exist without continually researching and leaving our minds open to using new methods of research’ (Onion.derby.ac.uk, 2016). A deductive approach starts with a statement or question and

research is undertaken to answer it (Wilson, 2010). The strategy identified for this research is action research using mixed methods, both quantitative and qualitative for data collection and analysis and was informed by previous research in this area (Davis et al., 2014; Laaksonen et al., 2013; Sabaretnam et al., 2014 and Whiting, 2015). A cross-sectional survey collects data to make inferences about a population of interest (universe) at one point in time. Cross-sectional surveys have been described as snapshots of the populations about which they gather data (Hall, 2008). A short term cross-sectional study was used here as the research was constricted by the academic calendar and semesterization within Lyit.

Table 3.1: Analogous layers of ‘Research Onion’ used to inform research undertaken in this study.

Progression through Saunders ‘Research Onion’ for research undertaken in this study	
Layer:	Research Stance:
1: Philosophical Stance	Realism
2: Approaches	Deductive
3: Strategies	Action Research
4: Choices	Mixed Methods
5: Time Horizons	Cross-sectional
6: Techniques and Procedures	Data collection: Questionnaires and Interviews Data analysis: Triangulation, interpretation of research issues by qualitative and by some quantitative methods

3.4.2 Research approach and strategy

The research approach taken by this study is framed by existing theory and as such is deductive in its stance. Action research was chosen as the framework to investigate the objectives of this study. Data collection was through qualitative methods and is reflective of previous studies carried out in this area by Burstein et al., (1996), Davis et al., (2014), Laaksonen et al., (2013), Whiting (2015) McDonough (2012), Griffard et al., (2013) and Sandefur and Gordy (2016).

3.4.2.1 Action Research

The coining of the term Action Research is often attributed to Kurt Lewin in the 1940s who, as a working psychologist, described a method for generating knowledge about a social situation, while, at the same time, attempting to change it (Lewin, 1946).

There are numerous definitions for action research (Masters, 1995) however, Kemmis and McTaggart (1990) definition ‘a form of collective self-reflective inquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of these practices and the situations in which these practices are carried out’ is often cited in educational action research. Action Research as ‘...a systematic process of enquiry, reflection and action undertaken to understand, evaluate and change an area of one’s professional practice in order to improve it’ (Costello, 2003) is also often cited by educational researchers too.

The idea that Action Research is a ‘personal’ form of research, and as such reflection, is evidenced in the literature. Munn-Giddings (2012) raises the idea that, in contrast to most research that employs ‘expert’ researchers, action research is carried out by ‘insiders, defined as those facing the situation or trying to develop their practice, as opposed to an external ‘outside’ research expert who does research ‘on’ other people’s problems or practices’. Action Research is not purely quantitative or qualitative in its focus, the purpose of Action Research is to work towards a change in the researchers practice (Winter and Munn-Giddings, 2002). The Action Research process is defined as having four characteristics such as; its practical nature; its focus on change; the involvement of a cyclical process; and its concern with participation (Descombe, 2007).

Costello (2003, 2011), Descombe (2003, 2007, 2014) and Norton (2009) have all written extensively on Action Research, or applications of the same. The Action Research process of enquiry is often viewed as one that alternates between enquiry and action. It is often cyclic in its nature taking on board findings from one cycle and using these findings as a planning point for the next cycle of enquiry. Costello (2003) laid out a basic model of cyclical research for this type of enquiry: plan, act, observe and reflect that is based upon the work of Zuber-Skerritt (1992). Another Research Action model often used in educational is the Norton action research model. This model suggest that the researcher firstly, observes an area requiring improvement,

secondly, plans a course of action which includes an element of change, thirdly, implements that change and lastly reflects upon the process (Norton 2009).

Action Research has evolved into many different types, such as participatory action research, emancipatory action research, design-based action research and collaborative inquiry (Willis and Edwards, 2014) and is seen as a possible capstone methodology in professional practice for educators (Zuber-Skerritt et al, 2015). However, the model used in this study will be that of Norton which has been effectively used in educational research particularly in a recent paper on journal club use and participation in undergraduate nursing (Whiting, 2015).

3.4.2.1.1 Reflection in Action Research

A core principle of action research methodology is critical reflection on research. The first three requirements, observe, plan and implement change of the four stage cyclical Norton action research model that will be used in this research, will be designed and evidenced by previous research undertaken in the use of journal clubs in various research settings. The final caveat of reflection, as part of an action research model, is well documented in the literature (Norton, 2009; Costello, 2011; Descombe, 2014; Dick, 2015) Descombe, (2003) states that it is not enough to be reflective in this process but to be critically reflective is essential otherwise there is no impetus for action ‘And here a distinction needs to be made between the ‘reflective practitioner’ as one who strives for professional self-development through a critical consideration of his or her practices, and the action researcher who, while also being a reflective practitioner, adds to this by using research techniques to enhance and systematize that reflection.’ (Descombe, 2003). This is supported by a recent publication by Murdoch-Eaton and Sandars (2014) which called for reflection to move from a mandatory ritual using well established frameworks into an instrument of rich professional enhancement. Various models of reflection have been used in science education (Runnel et al., 2013; Parker and Heywood, 2013) and there are numerous models of reflection at use within action research such as Kolb (1984), Gibbs (1998), Modified Gibbs (Dye, 2011), Atkins and Murphy (1993), Johns (2006) and Driscoll (2007). Johns (2006) model for structured reflection includes reflexivity and is designed from earlier work by Carper (1978). The model that the researcher is most familiar with is a modified Gibbs cycle of reflection (Lia n.d.) and this will be used within the action research framework for this study.

3.4.2.2 Questionnaires

The questionnaire is a widely used and useful instrument for collecting survey information and providing structure, often numerical, data for educational research purposes (Cohen et al., 2011). Questionnaires are thought to be advantageous over other survey methods as they allow for anonymity of the respondent and therefore encourage honesty in answering, greater reliability when compared with interviews and economy in terms of time and money (Cohen and Manion, 1995 and Oppenheim, 1992 as cited in Madhi, 2014). A formal standardised questionnaire was used as the survey instrument in this research. A questionnaire is said to be standardized when each respondent is exposed to the same questions and the same system of coding responses and data analysis (Siniscalco and Auriat, 2005). Questionnaire design was influenced by Saunders, et al., (2012); Cohen et al., (2011) and Artino et al., (2014) with a mixture of question types, from dichotomous to open ended questions and rating scale questions using Likert scales (Likert, 1932). Likert-type questions, also known as frequency scales use fixed choice response formats to measure attitudes or opinions (Bowling, 1997; Burns and Grove, 1997). The Likert-type of question used in this research had six choices, (none, very little, moderate amount, a lot, quite a lot and a very great deal) and was used previously in other research within Lyit (Brown, 2015).

In this research study, two identical questionnaires were administered to the research cohort. The first questionnaire was administered prior to the journal club intervention, the second questionnaire was administered after completion of the journal club exercise. It was hoped that any change in students' perception of engagement or attitudes to primary scientific literature could be garnered from this research instrument. A copy of the questionnaire can be found in Appendix 5.

3.4.2.2.1 Piloting of questionnaire

The questionnaire was initially pilot tested using three colleagues which completed the questionnaire and commented on any issues or difficulties that arose during completion. The first colleague was a team teacher on the Molecular Biology module, the second was a member of the same department who had little knowledge of the subject area and the third was a member of a different department who had experience in questionnaire design. Minor issues that arose were addressed.

The questionnaire was then piloted using three students from the level 7 B.Sc. programme in Bioscience. Although these students are not at the same level of experience as the research cohort, it was felt that the questionnaire was ubiquitous in its design to allow this to pilot test to occur. No issues were reported.

3.4.2.3 Interviews

Interviews for collection of qualitative data in educational research is well established (Torrance, 2010; Merriam, 1998; Yin, 2015). Cohen et al., (2011, p.412) have illustrated various types of interviews used in educational research ranging from structured to unstructured. Semi structured interviews were chosen for this research as they allow for a series of questions to be asked in a similar manner to all interviewees to facilitate comparison between candidates, while also permitting the opportunity to discuss further any new aspect that emerged during the individual interview (DiCicco-Bloom and Crabtree, 2006). Semi structured interviews were carried out after completion of the journal club and questions asked where cognisant of the research study aim and objectives (Saunders et al., 2012) and constructed based on preliminary data analysis of both pre- and post- journal club questionnaires. All journal club participants were asked to partake in this process, three students volunteered and were interviewed. Interviewees were given the questions prior to the interview and copies of the interview questions and preparatory worksheets are located in Appendix 8. Interviews were recorded and transcribed. Interviewees were allowed to read, edit and clarify any issues they had with their interview transcripts and copies of these can be found in Appendix 7. Table 3.2 has been adapted from Hannigan (2016) and illustrates the data collection methods used to support each of the three research objectives.

3.4.3 Data Analysis

3.4.3.1 Validity and reliability

With respect to reliability and qualitative research, where this research study is embedded, no clear consent appears to exist amongst researchers about its relevance or exact definition (Bryman and Bell, 2011; Noble and Smith, 2015). Reliability in the context of a research study is often referred to as whether its results are repeatable (Cohen et al., 2011). Reliability for qualitative studies can be considered to be either external or internal. External reliability refers to the extent a study can be replicated and internal reliability is concerned with the level of agreement amongst researchers within a team regarding their observations (Bryman and Bell, 2011).

Table 3.2: Data collection methods employed to address each research objective for undertaken study.

Research Title	To investigate the use of an undergraduate journal club as an engagement tool to encourage/facilitate students' interaction with primary scientific literature.	Research Method/Data Collection Method
Research Objective 1	To ascertain if undergraduate science students are engaging with science literature.	Pre-Journal Club Questionnaire
Research Objective 2	To appraise if participation in an undergraduate journal club increase students' perception of engagement with science literature.	Post-Journal Club Questionnaire
Research Objective 3	To evaluate if participants of an undergraduate journal club perceive enhancement of their learning experience in undergraduate science.	Post-Journal Club Questionnaire Interview

Validity is concerned with the integrity of the outcome of research studies. James Ayodele (2012 p.391) suggests that 'validity hinges on the extent to which meaningful and appropriate inferences or decisions are made on the basis of scores derived from the instrument used in a research'. Cohen et al., (2011) have an extensive list of different types of validity within educational research some are more applicable to quantitative research, however, qualitative research has to be valid within its own right.

In order to ensure reliability and validity a triangulation approach was chosen. Triangulation may be defined as the use of two or more methods of data collection in the study of some aspect of human behaviour (Cohen et al., 2011; Noble and Smith, 2015). In this research study, questionnaires and interviews were both used as data collection methods to reduce bias and and improve accuracy and validity (Saunders et al., 2012). The supervisor assigned to the researcher also has an important role in ensuring that the research proposed is mindful of the need for validity and reliability.

3.4.3.2 Qualitative Analysis

For this research study, a realism paradigm was used and this was researched using an action research process. Qualitative analysis with descriptive statistics is used similarly to Laaksonen et al., (2013), Whiting, (2015) and Sandefur and Gordy, (2016).

3.4.4 Conclusion to Research Methodology

From reading relevant literature on the use of journal clubs in education, whether it be at postgraduate or undergraduate level, and engaging with numerous publications on educational research, a qualitative approach framed in action research was the choice of methodology used to explore the research aims and objectives for this study.

3.5 Evaluation of Research Study

The choice of framework to investigate the aim and objectives for this research was Norton's action research model as stated in Section 3.4.2.1. This model suggests that the researcher, firstly, observes an area requiring improvement, secondly, plans a course of action which includes an element of change, thirdly, implements that change and, lastly, reflects upon the process (Norton, 2009). This section will be ordered within the framework of this four-part model with discussion of data collected and analysis incorporated into the reflective element.

3.5.1 Observation

From personal reflection on my teaching career to date, I have become increasingly aware that engagement with scientific literature at undergraduate level, whether primary (in the form of peer reviewed research papers) or secondary (in the form of scientific textbooks), appears to be in decline. Students at all levels in undergraduate programmes appear to no longer purchase a hard copy, or any copy of the recommended text for the subject they are studying. There appears to be a belief that access to relevant material on-line is enough to constitute engagement with the recommended content. However, in my experience, this is not been supported by the quality of submitted formative assessment or summative examinations.

The expectation that students in their final years of undergraduate study engage with peer reviewed literature to support their work is not unique to the discipline of science. Engagement with literature is acknowledged as an important element of science education and is supported by the QQI science award standards (QQI, 2014; Section 3.1.1 and Section 3.1.2), there is also the same remit for business (QQI, 2014a), engineering (QQI, 2014b), computing (QQI, 2014c) and nursing awards (QQI, 2014d).

Encouraging engagement with scientific literature for undergraduate level science students has seen use of several strategies such as trade books (Fang, 2013), book club (Griffard, et al., 2013), concept map based science book reading using mobile devices (Yang et al., 2013), Real Simple Syndication (Pence and Pence, 2008), Internet social tagging (Pence and Pence, 2009) the C.R.E.A.T.E. method (Hoskins, 2008; Hoskins, 2010; Hoskins, Stevens and Nehm, 2007; Hoskins et al., 2011; Gottesman and Hoskins, 2013; Hoskins and Krufka, 2015; Kenyon et al., 2016) and journal clubs (Rauschert et al., 2011; McDonough, 2012; Sandefur and Gordy, 2016). The use of scientific literature in Evidence Based Nursing or Medicine is well documented (Thygeson, 2008; de Souza et al., 2015; Hassanzadeh et al., 2014; Belowska

et al., 2014) and the use of scientific literature in the journal club settings with respect to Evidence Based methodologies is extensively published (Häggman-Laitila et al., 2016; Mattila et al., 2013 and Harris et al., 2011).

The choice to use journal club, as a tool to facilitate engagement with scientific literature, instead of other strategies presented above, came from having extensive personal experience of facilitating journal clubs within postgraduate science research environments. I hold the belief that journal club has the ability to address engagement with science literature and communication skills simultaneously. Both skills, in my opinion, are essential for graduates of science programmes and are applicable for use in their graduate careers. However, the limited information on journal club as an effective tool for engaging student with scientific literature at undergraduate level led to this research study being planned and executed.

3.5.2 Plan

There is literature published on the structuring and running of journal clubs but this mainly addresses journal clubs at postgraduate level in either medical or nursing education settings. Alam and Jawaid (2009) have shown that factors which have been associated with effective journal clubs in medical education are: clear learning objectives, a designated club leader, compulsory attendance of trainees with regular attendance of faculty members, formal teaching of critical appraisal skills, the use of a structured checklist for article under review and provision of free food. Deenadaylan et al., (2008) carried out a synthesis of the published literature regarding the process of conducting an effective journal club in health settings. They propose guidelines for the structure of an effective journal club which include mandatory attendance at regular intervals with incentives such as food to attend, a journal club leader, use of structure worksheets and evaluation of knowledge uptake formally or informally. Anzarut et al., (2011) looked at the quality of and satisfaction with journal clubs in a medical setting. Through the use of positive defiance they saw statistical improvement across five targeted domains which were: the quality of articles chosen, presentations, post presentation discussions, educational benefit and overall satisfaction with the journal clubs. This was achieved through endorsement by a surgeon of articles chosen by residents, strict and rigid timing of presentations, standard template for summarization of the presented papers and formal training of staff in critical appraisal of literature prior to journal club. Davis et al., (2010) carried out an action research study over a period of four academic years on journal club integration into postgraduate nursing education. They suggest the following considerations

upon starting a journal club: keep group size small (maximum 10 people, plus a facilitator), start by having the facilitator choose the journal articles, make the article, or details of the article, available to the group at least a week before the meeting, ensure that an experienced facilitator presents the article in the first journal club meeting, ensure that the facilitator has some knowledge of the topics and research methodology and ensure that sufficient time is provided for structured discussion and that all participants are encouraged to voice their opinion as a contribution.

The initial research plan for the implementation of a journal club into an undergraduate setting, as a tool to encourage engagement with primary scientific literature, was timetabled to run over an academic semester of thirteen weeks with a weekly journal club held during designated lecturing hours. The structure and layout of each hour was given consideration based on the literature findings above and is illustrated in Table 3.3. Some of the suggestions from above (such as incentives to attend and critical appraisal workshops) were not taken forward into the planning of this research as the intention of this journal club was to mediate the engagement of students with primary scientific literature in the first instance rather than refining their critical appraisal skills as is often the focus of journal club in postgraduate medical education settings.

The use of a structured review instrument was taken on board in the planning of this research. Burstein et al., (1996) established that the introduction of this tool into a journal club setting actively increased participant satisfaction and enhanced the perceived educational value of journal club. The inclusion of a structured review instrument is also supported by Whiting (2015) who reported students' appreciation of a steering handbook guide to navigate the implementation of a journal club in nursing education. The chosen structured review instrument, an article review form, was taken from the American Society of Parenteral and Enteral Nutrition (ASPEN) journal club kit (ASPEN, 2015) and is shown in Appendix 9.

Table 3.3: Planned structure of journal club delivery and format for research study.

Week #	Planned Journal Club Structure and Format
1	<ul style="list-style-type: none"> • Introduction and definition of Journal Club. • Dissemination of relevant material for informed consent
2	<ul style="list-style-type: none"> • Collection of informed consent forms • Introduction of article review tool • Participant decision on topics to review during journal club that support Molecular Biology module • Allocation of group members for presentation of papers • Random allocation of topics to groups • Distribution and collection of questionnaire #1
3	<ul style="list-style-type: none"> • Groups to submit paper chosen for presentation for approval and uploading on VLE • Presentation of paper by myself and group discussion to demonstrate how journal club actually works
4	Group 1 presentation at journal club
5	Group 2 presentation at journal club
6	Group 3 presentation at journal club
7	Group 4 presentation at journal club
8	Group 5 presentation at journal club
9	Group 6 presentation at journal club
10	Group 7 presentation at journal club
11	Group 8 presentation at journal club
12	<ul style="list-style-type: none"> • Discussion on journal club experience • Distribution and collection of questionnaire #2 • Dissemination of relevant material for interviews
13	Interviews

3.5.3 Act

The planning of the research study as indicated in Table 3.3 and its implementation were not commensurate. Ethical approval was not obtained until week eight of the academic semester, which was not factored into the planning and, as such, a revised format and structure for the research study was implemented where journal club ran over a five week period, from week

nine to 13 of the academic semester and two papers were presented at each journal club timeslot, see Table 3.4.

Table 3.4: Actual structure of journal club delivery and format for research study.

Week #	Actual Journal Club Structure and Format
8	<ul style="list-style-type: none"> • Introduction and definition of Journal Club. • Dissemination of relevant material for informed consent • Collection of informed consent forms
9	<ul style="list-style-type: none"> • Introduction of article review tool • Participant decision on topics to review during journal club that support Molecular Biology module • Allocation of group members for presentation of papers • Random allocation of topics to groups • Distribution and collection of questionnaire #1
10	<ul style="list-style-type: none"> • Groups to submit paper chosen for presentation for approval and uploading on VLE
11	<ul style="list-style-type: none"> • Group 1 & 2 presentations at first weekly journal club • Group 3 & 4 presentations at second weekly journal club
12	<ul style="list-style-type: none"> • Group 5 & 6 presentations at first weekly journal club • Group 7 & 8 presentations at second weekly journal club • Distribution and collection of questionnaire #2
13	<ul style="list-style-type: none"> • Dissemination of relevant material for interviews • Interviews

3.5.4 Reflection with Discussion

As indicated previously in Section 3.3, the research cohort for this study comprised of nineteen final year undergraduate students partaking in a ten credit Molecular Biology module that I was delivering as part of a level 8 honours degree in Bioanalytical Science in the Department of Science in Lyit. All nineteen students completed and submitted their informed consent paperwork, fourteen completed the pre-journal club questionnaire and nine completed the post-journal club questionnaire. The abating of student participation from this voluntary research was disappointing but not unexpected, and both genders had equal decline in completion of

questionnaires see Table 3.5. Appendix 10 contains the raw data used in the construction of this table.

Table 3.5: Comparison by gender of completion rates of documentation associated with data collection for research study.

Gender	All	Female			Male		
		Number	Per cent of Total Participants	Per cent Reduction	Number	Per cent of Total Participants	Per cent Reduction
Informed Consent	19	15	79		4	21	
Questionnaire #1 (pre-journal club)	14	11	79	27	3	21	25
Questionnaire #1 (post-journal club)	9	7	78	55	2	22	50
Interview	3	2	66.6	87	1	33.3	75

Some of this reduction in participation can be accounted for by two female members of the cohort removing themselves from full time education in week nine of the semester, other reasons were students' health, as a viral flu was circulating around the Department of Science at this interval, and there was noted reduction in attendance across all degree programmes at this juncture. However, one of the main reported reasons, by students informally speaking with me, was the timing of this research study and this is reflected in the conversation held during the interview process carried out at the end of the research study.

'It was a short period of time for, with you know, confirmation that you could go ahead then us actually been able to achieve that within the short period of time frame but if that was maybe extended I think everybody would get more benefit out of it because everybody would be able to read round it more'

Interviewee #1

'I would have liked to have started it earlier on in the year and done it throughout the year.'

Interviewee #2

At the end of this particular academic semester this research cohort has to submit a 6,000 word science literature review that supports independent research projects which are undertaken by this cohort in semester two of the academic year. I strongly believe that the timing and implementation of this research study at the later part of an academic semester contributed to the decline in participation. Students' workload increases at this time, either by lecturers trying to complete their modules within the time given, or procrastination of students in preparing for summative work that is due at the end of term. Upon reflection, the addition of a voluntary journal club that requires substantial extra work, such as locating and finding a relevant primary literature paper, preparation of a presentation on this literature, reading of all submitted literature from other participants, with no tangible summative benefit in the form of contributory final marks was an unrealistic expectation in the final five weeks of an academic semester.

The rationalisation for the choice of questions on the questionnaire survey is previously addressed in Section 3.4.2.2. For this study, I was interested in ascertaining information about this research cohort's perception of engaging with primary literature, as defined previously in Section 1, for this study, prior to and post the journal club intervention. I hoped to ascertain whether or not they were engaging with primary scientific literature in the first instance and was curious as to whether they felt they had support in developing the skills necessary to access this scientific information. This initial aim is reflective of Research Outcome #1. Whether or not there were changes in their access to and time spent with primary science literature by this journal club intervention was another area I wished to investigate and is echoic of Research Outcome #2. The final Research Outcome, #3, was designed to evaluate if the students perceived any other enhancement of their learning experience over and above engagement with primary literature by this intervention. Each Research Outcome will be addressed in its own right forthwith, substantiated by data collected from both pre- and post- journal club survey questionnaires and supported by information obtained through interviews held after completing the journal club intervention.

3.5.4.1 Research Outcome #1: To ascertain if undergraduate science students are engaging with science literature

This research cohort is in their final year of an honours degree programme and there was an expectation, on my behalf, that they would have a good level of engagement with both the recommended text book, the supplementary text books and peer reviewed scientific literature for this Molecular Biology module prior to participation in this research study. This expectation was supported when 100 per cent of the research cohort reported in the pre-journal club questionnaire that they had access to the essential reading for the Molecular Biology module (Question 3) and that they had previous experience of sourcing peer reviewed journal articles (Question 6) (see Appendix 10).

What was an interesting finding, when further probing of Question 3, (which focused on their access to the essential reading for this module), was explored in Question 4, no student had purchased a hard copy of the essential text, 29 per cent purchased an e-copy, while 93 per cent had accessed the books through the Lyit library, see Figure 3.2. Furthermore 35 per cent of the research cohort had accessed the essential reading by free downloading of the books online or through google scholar (Appendix 6). This would suggest that no student purchased an e-copy, (which was specifically asked in this question) but rather downloaded a version of the essential text. Whether or not this download was legal, was not qualified in this questionnaire and as such is outside the remit of this study; however, it is an issue that should be addressed if this questionnaire were to be reused again in future research studies.

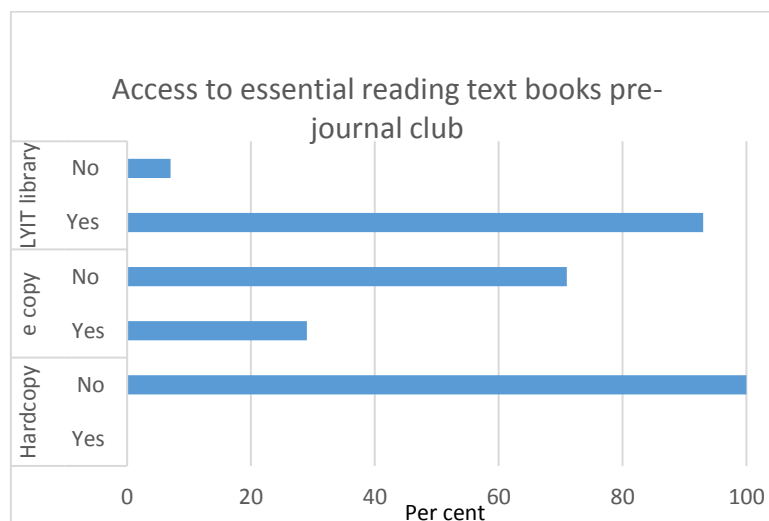


Figure 3.2. Students' choices of how to access the recommended essential reading text books for Molecular Biology pre-journal club research study (Descriptive data from Question 4 pre-journal club survey questionnaire see Appendix 10).

Further insight into Question 6 was gathered from Question 7 which enquired what students found straight forward and/or difficult about sourcing peer reviewed articles (Appendix 6). One theme that emerged was that access through Lyit, specifically the Science Direct database, was convenient and straightforward, filter options were numerous and simple to use; however, a lot of the papers were not free to download but had to be purchased. Another theme that emerged revealed difficulties in understanding what substantiated a 'good' journal and the use of technical language and acronyms which made these articles difficult to grasp.

Another aspect which I was interested in evaluating, through this research, was the students' perception of support and training they had received/not received with respect to sourcing and using scientific literature previously. Question 9, on the pre-journal club questionnaire, supported my assumption that this research cohort was previously supported and trained in the sourcing and appropriate use of scientific literature prior to this intervention and undertaking this research. (Figure 3.3). The students were equally divided with respect to using the library for research, with 50 per cent stating that they had very little or a moderate amount of support and training, while the remaining 50 per cent stated that they had a lot, quite a lot or a very great deal of support. With respect to scientific database searching, 72 per cent stated they had a lot, quite a lot or a very great deal of support and training with only 28 per cent stating they had very little or a moderate amount. Support and training in the appropriate use of scientific literature showed that once again 72 per cent reported they had a lot, quite a lot or a very great deal of support with 28 per cent stating they had very little or a moderate amount. Support and training in the use of Harvard UL referencing again reflected that greater than three quarters of the cohort felt that they had a lot, quite a lot or a very great deal of support.

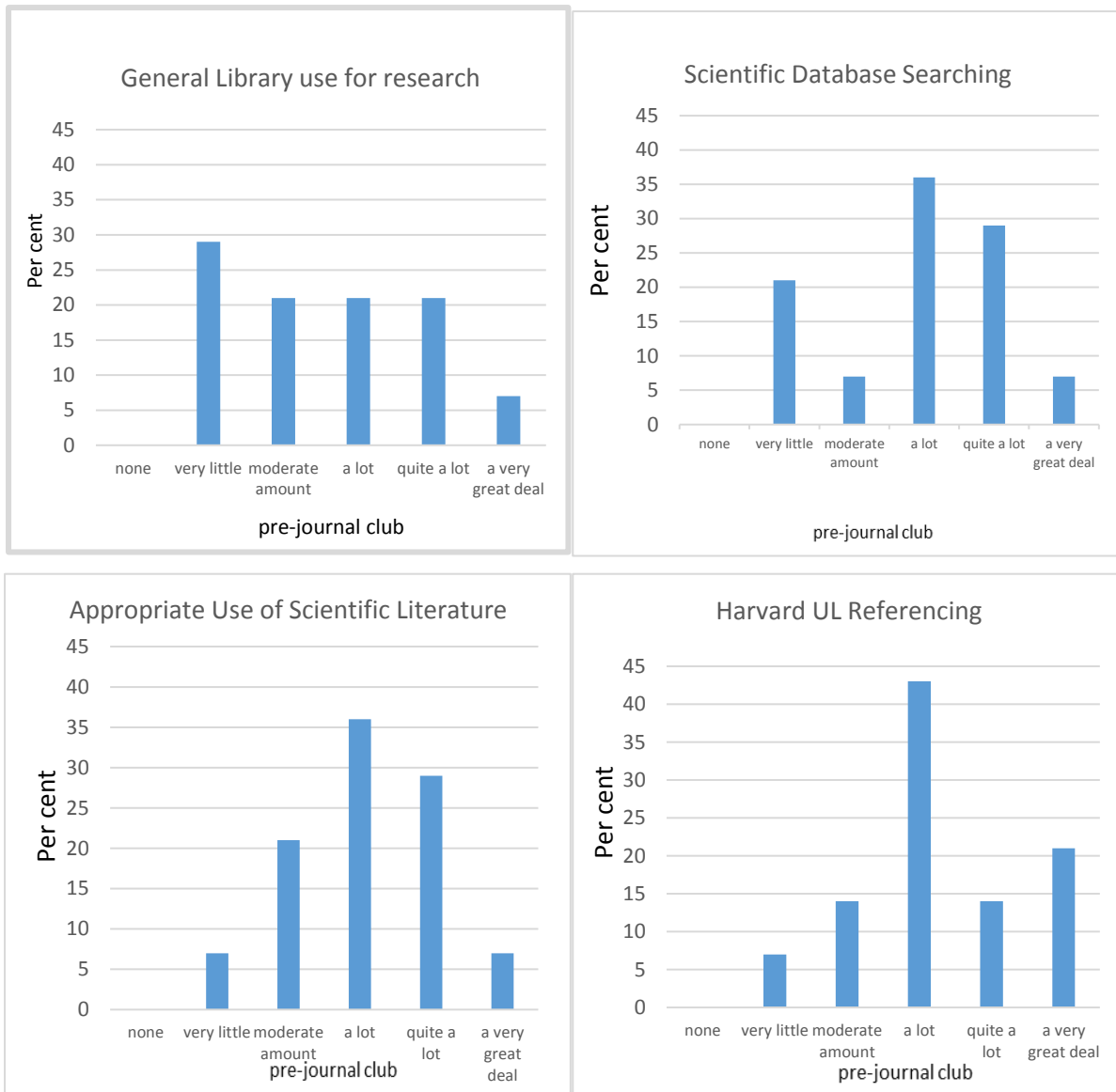


Figure 3.3. Students' perception of how much support and training they received through the School of Science in using routes of access to sourcing scientific literature pre-journal club research study (Descriptive data from Question 9a, b, c and d, pre-journal club survey questionnaire see Appendix 11)

No student stated that they had no support or training in this area, which was as expected at this stage in their studies. These students have had exposure to the utilisation of library resources and databases on numerous occasions during their academic careers within Lyit and were re-introduced to Harvard UL referencing by the Communication Learning Centre at Lyit on week 2 of the academic semester during this module in preparation for continuous assessments.

The ability to use and source scientific literature is an essential skill for any scientist and its importance is reflected in its inclusion in the QQI science award standards (QQI, 2014). However, Donnelly and Fitzmaurice (2005, p. 96) state that ‘ It could be argued that the skill of the twenty first century graduate will be to articulate the right questions and to understand where and how they can search for knowledge, not remember the answers’. The ability of science graduates to search and interpret scientific knowledge cannot be understated. Ensuring that students engage appropriately with scientific literature at undergraduate level is a way to ensure that they are information literate, where this is defined by the UK based Chartered Institute of Library and Information Professionals (Cilip.org.uk, 2004) as ‘Information literacy is knowing when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner’ (Armstrong et al., 2005), throughout their careers. I would find myself in agreement with Barnes et al., (2007) who reported that although students’ information technology skills are well developed, they lack the information literacy skills and critical thinking skills needed to negotiate this complex information arena effectively. This is also supported by the students’ themselves in their answers for Question 7, pre-journal club, with respect to the theme that emerged of difficulties in understanding what substantiates a ‘good’ journal and the use of technical language and acronyms.

Another issue that I am cognisant of is the level and depth of this engagement with scientific literature among the student cohort. I would expect that students in their final year of their degree programme would be using the higher levels of Bloom’s taxonomy (Bloom et al., 1956; Krathwohl, 2002) in that they would be synthesizing and evaluating their knowledge, and that the journal club would be a learning tool that further enabled these skills to be fostered; however, this expectation was not reflected in information ascertained from interviews with these students. Interviewee #2 did not show synthesis or evaluation of scientific literature prior to journal club; this is not what I had expected from a level 8 research student cohort.

‘Understanding at the outset was reading journals and not much moresometimes you would read them from a student’s perspective, you would read them and glance over them and certain things just didn’t really stick out’

Interviewee #2

3.5.4.2 Research Outcome #2: To appraise if participation in an undergraduate journal club increases students' perception of engagement with science literature

To substantiate this research outcome with data, a comparison was made between the information given by the students in the pre-journal club and post-journal club questionnaires. As shown in Table 3.5, there was a significant reduction in the number of survey questionnaires submitted from pre- to post- journal clubs and one has to be attentive that this could affect the reliability and validity of the data presented. I also have to be cognisant that, although 19 students signed informed consent documentation, only 14 filled out pre-journal club questionnaires, while 9 submitted post-journal club surveys; and as such, it is difficult to ascertain if data from the same students has been captured in both surveys.

As outlined previously in Section 3.5.1.1, my expectation of a high level of engagement with scientific literature for this research cohort was justified and once again was supported in the post-journal club survey questionnaire when 100 per cent of the research cohort reported that they had access to the essential reading for the Molecular Biology module (Question 3). However, there was a change in the sourcing of the essential reading, with an approximate 50 per cent increase in e-copy sourcing (pre- 29 per cent, post- 57 per cent) and a 15 per cent decrease in accessing the books through the library (pre- 93 per cent, post- 78 per cent). An interesting find was that a change was reported in the students reporting of previous experience of sourcing peer reviewed journal articles (Question 6) from pre-journal club (100 per cent) to post-journal club (89 per cent). One male participant, who may not have filled out the pre-journal club questionnaire, stated that he had not had previous experience of sourcing peer reviewed journal articles and stated in Question 8 that the reason for this was 'because it was not emphasised before now'. I found this quite alarming as I know there is an expectation, within the science department, of peer reviewed literature to support practical laboratory write ups and continuous assessments such as essays from level 6 upwards.

Students perceived an enhancement in support and training for sourcing and appropriate use of scientific literature after undertaking this research. With respect to using the library for research, the cohort in their pre-journal club questionnaires, stated that 50 per cent of them had a lot, quite a lot or a very great deal of support; post-journal club this was reported as 78 per cent (Question 9a). With respect to scientific database searching, 72 per cent, pre-journal club, stated they had a lot, quite a lot or a very great deal of support and training while post-journal club this was stated as 89 per cent (Question 9b). In relation to support and training in the

appropriate use of scientific literature pre-journal club 72 per cent reported they had a lot, quite a lot or a very great deal of support while post-journal club this was stated as 89 per cent (Question 9c). In relation to support and training in the use of Harvard UL referencing (Question 9d) both pre- and post – journal club, greater than three quarters of the cohort felt they had a lot, quite a lot or a very great deal of support. Data supporting these findings is included in Appendix 11

Two Likert-type questions in particular were used in the questionnaire to ascertain whether participation in a journal club increased students' perception of engagement with scientific literature and these were Questions 10 and 11. Question 10 focused on experience of accessing primary science literature engagement, while Question 11 related to time spent interacting with primary science literature. Question 10a showed that there was a positive drift in how often this research cohort engaged with recommended essential reading text books, with 42 per cent, pre-journal club, stating they had a lot, quite a lot or a very great deal of engagement, while post-journal club, they reported 77 per cent. Not surprisingly, but noteworthy all the same, is the lack of change in how often these students accessed the recommended supplementary reading text books for this module (Question 10b). Irrespective of the journal club intervention, engagement with this type of scientific literature is very low with 72 per cent of students' pre-journal club stating they have none, very little or a moderate amount of engagement. Although this was very slightly reduced to 66 per cent post-journal club, it gives pause to consider whether recommending supplementary text books is helpful to students in any remit. Of particular relevance is the students' perception of how often they accessed peer reviewed journal articles pre- and post- journal club (Question 10c). There is a significant change in students reporting that they accessed this material quite a lot and a very great deal, with students rating this at 35 per cent pre-journal club but at 66 per cent post-journal club. Although the students' rating of none, very little or moderate amount of accessing did not significantly change pre- (36 per cent) or post- (33 per cent) journal club, the perception of how often they accessed the material is greatly increased. This finding would support the use of a journal club to increase engagement with peer reviewed scientific literature in an undergraduate setting. Question 10d showed a dramatic increase in how often this student cohort accessed science specific website, such as Science Daily, post-journal club intervention. Prior to journal club, 50 per cent of students rated their accessing as lot, quite a lot or a very great deal while after journal club this increased by 39 per cent to 89 per cent (see Figure 3.4).

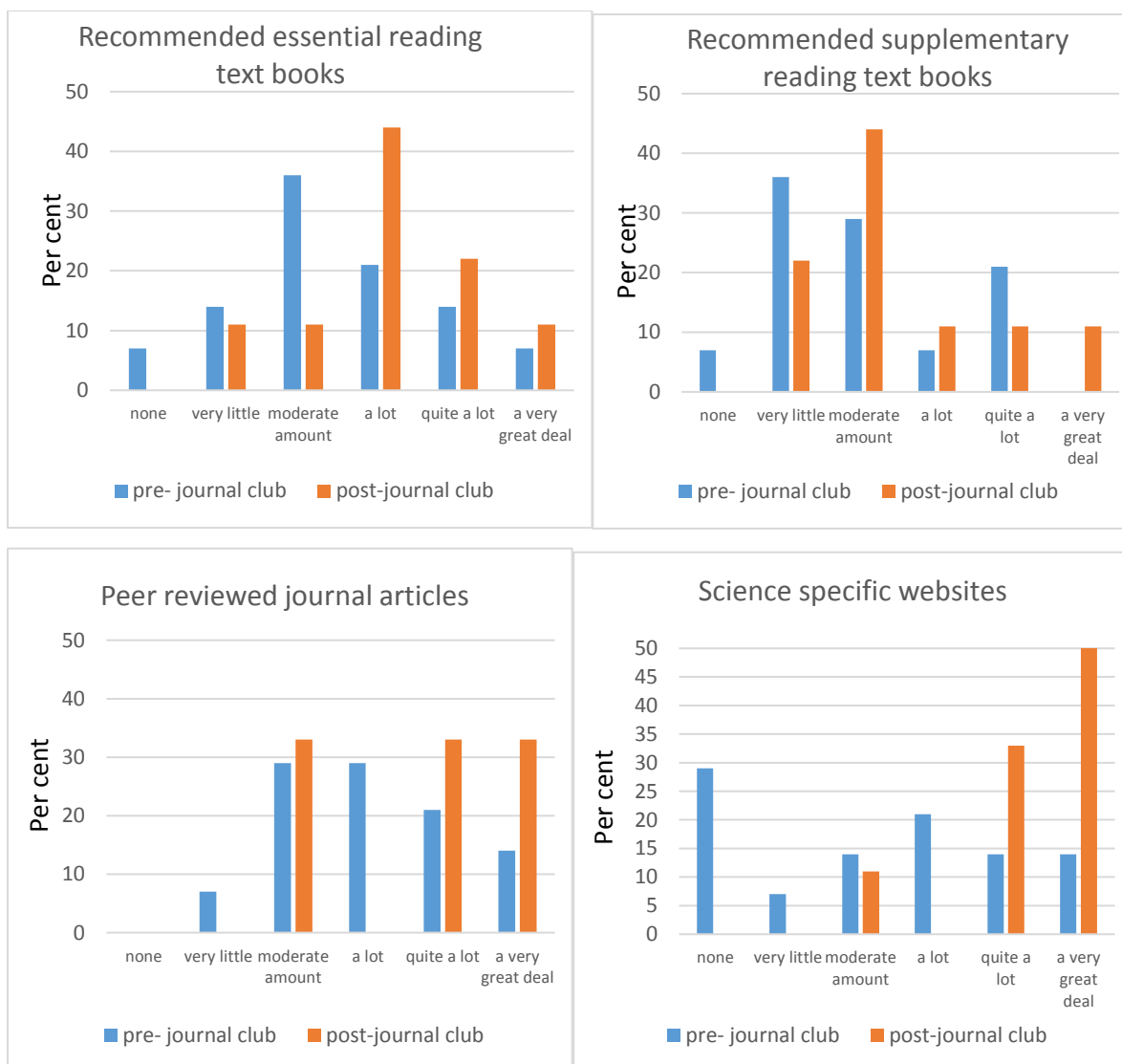


Figure 3.4 Students' perception of how they rated their experiences accessing different types of scientific literature pre- and post- journal club intervention study (Descriptive data from Question 10a, b, c and d, pre-journal club and post- journal club survey questionnaire see Appendix 12).

Question 11 addressed the time spent interacting with primary scientific literature. The range of times chosen for the Likert scale were influenced by the proposed six hours of independent study on the module descriptor that is expected for a ten credit module in Molecular Biology (see Appendix 2). Pre-journal club, 35 per cent of students spent greater than 4 hours reading essential text books, this increased to 45 per cent post-journal club (Question 11a). In respect to supplementary text books, there was a small increase noted in students who spent greater than 4 hours which went from 7 per cent pre-journal club to 23 per cent post-journal club (Question 11b). This finding is reflective of the answer given in Question 10b. There appears

to be a dismissive attitude towards supplementary text books and the students do not spend their time or effort accessing or engaging with this material. Question 11c addresses the amount of time spent reading peer reviewed journal articles and this increased post-journal club with 100 per cent of students stating they spent greater than 4 hours on this task comparatively to 72 per cent pre-journal club. This is an interesting finding and would, once again, if taken in tandem with Question 10c support the introduction of an undergraduate journal club as a mechanism to promote scientific literature engagement. However, this should not be taken at face value as these students have another remit to engage with peer reviewed articles and this is the completion of their 6,000 word science literature review. Supporting the findings in Question 10d, where a dramatic increase was noted from pre- (39 per cent) to post- (89 per cent) journal club in how often students accessed science specific websites, is the increase in time, greater than four hours, that students reported which moved from 58 per cent pre-journal club to 88 per cent post-journal club (see Figure 3.5).

This finding is encouraging as it may suggest that this engagement with science specific websites has encouraged habits that promote lifelong learning, such as, accessing or being informed on a daily basis about novel findings in one's cognitive areas. This is reflective of findings from Pato et al., (2013) who reported that journal clubs promote lifelong learning in postgraduate medical education and Campbell-Fleming et al., (2009) who reported the same for post graduate nursing education.

The students' perception of enhancement of their engagement with scientific literature is also supported by comments during interview. All interviewees stated they increased their time spent reading peer reviewed literature and all suggested an increased ability to critically evaluate the scientific literature.

'I definitely have. I am able to read the literature and know what's good and what's bad literature and what's relevant and what's not, I think from using the journal club'

Interviewee #3

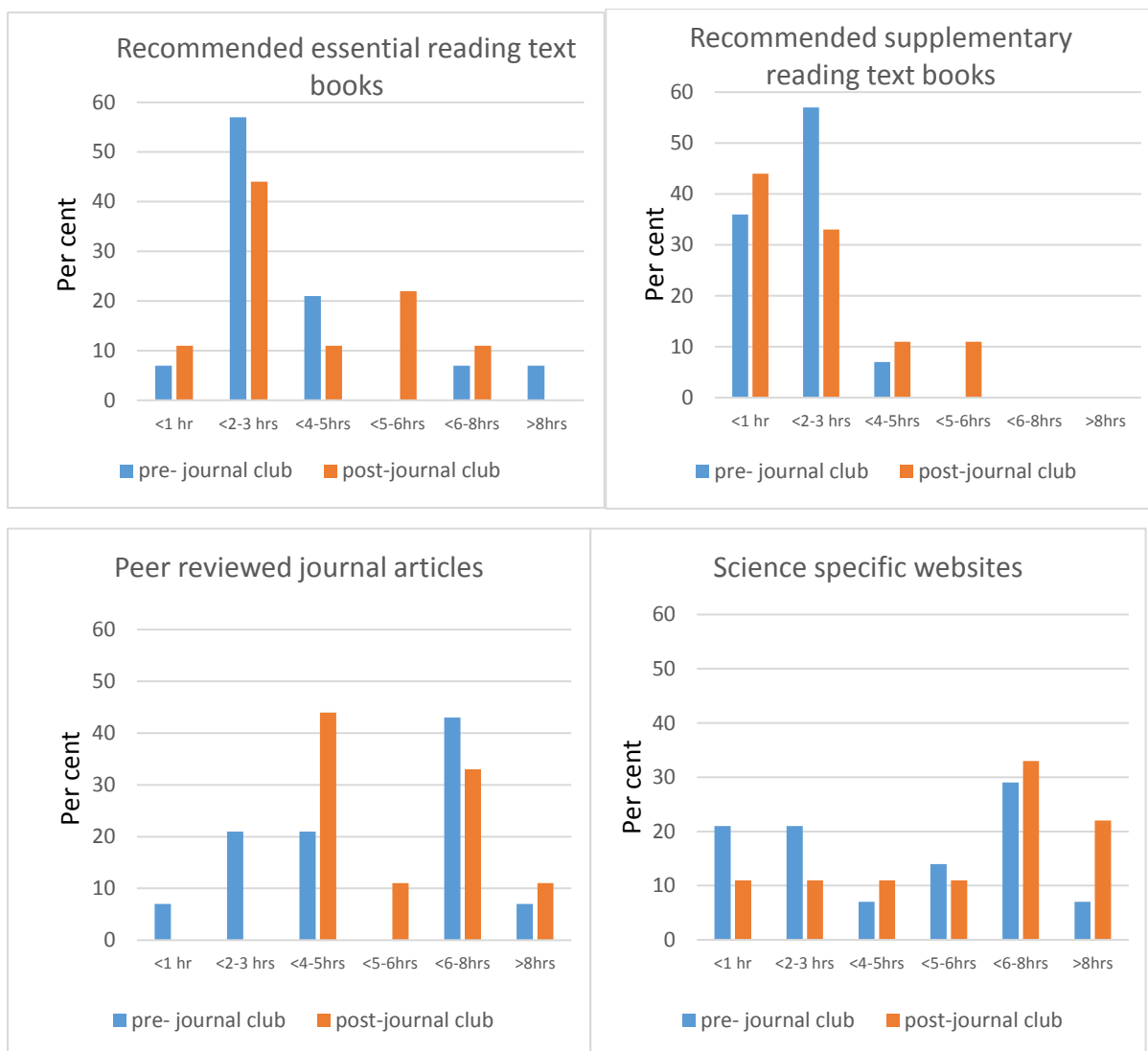


Figure 3.5. Students' perception of how much time they spent interacting with different types of scientific literature pre- and post- journal club intervention study (Descriptive data from Question 11a, b, c and d, pre-journal club and post- journal club survey questionnaire see Appendix 12).

When asked if their understanding and/or feelings had changed towards journal club, it appears for some, that they were scared, disorientated and sceptical at the beginning, however they perceived themselves to be more relaxed and found the literature more understandable post – journal club.

'It was scary at the start but now, ymmm a lot better.....it's more understandable. It was broken down a lot better. We were given a sheet with pointers on how to decipher the paperand those points would help with our study and interpreting it so it helped in that way'

Interviewee #1

3.5.4.3 Research Outcome #3: To evaluate if participants of an undergraduate journal club perceive enhancement of their learning experience in undergraduate science

There appears to be perceived enhancement of engagement, on behalf of the students, with scientific literature as evidenced above, however, as part of this research study, I also wished to discern if the research cohort perceived other enhancements in their learning experience, such as in their communication skills or confidence in sourcing and appropriately using peer reviewed scientific literature. Question 12 on the pre- and post- survey questionnaire was used to address this issue and was included to suggest whether or not these skills, as directed by QQI science award standards, could be enhanced by a journal club intervention. Figure 3.6 illustrates the findings for pre- and post- journal club exposure. The research cohort demonstrated an increase in their confidence of sourcing peer reviewed literature and in their ability to appropriately use this material for their college work. Confidence in sourcing this material was reported as increased from 42 per cent pre-journal club to 78 per cent post-journal club for students who rated their confidence as a lot, quite a lot or a very great deal. The ability to use this material appropriately was equally increased as that of confidence, with an increase from 42 per cent pre-journal club to 78 per cent post-journal club for students who rated their ability as a lot, quite a lot or a very great deal. Confidence in communicating with peers and the general public, with respect to peer reviewed journals, was substantially increased post-journal club. In terms of addressing peers this increase was from 28 per cent pre-journal club to 77 per cent post-journal club, for students who rated their confidence as a lot, quite a lot or a very great deal was evidenced. A smaller, but still significant, increase was noted for confidence in communicating this material with the general public, this was from 21 per cent to 56 per cent. These findings are reflective of those recently reported by Sandefur and Gordy (2016) whose student research cohort self-reported increases in their ability to apply the process of science and to communicate and collaborate after participation in an undergraduate journal club in a science educational setting.

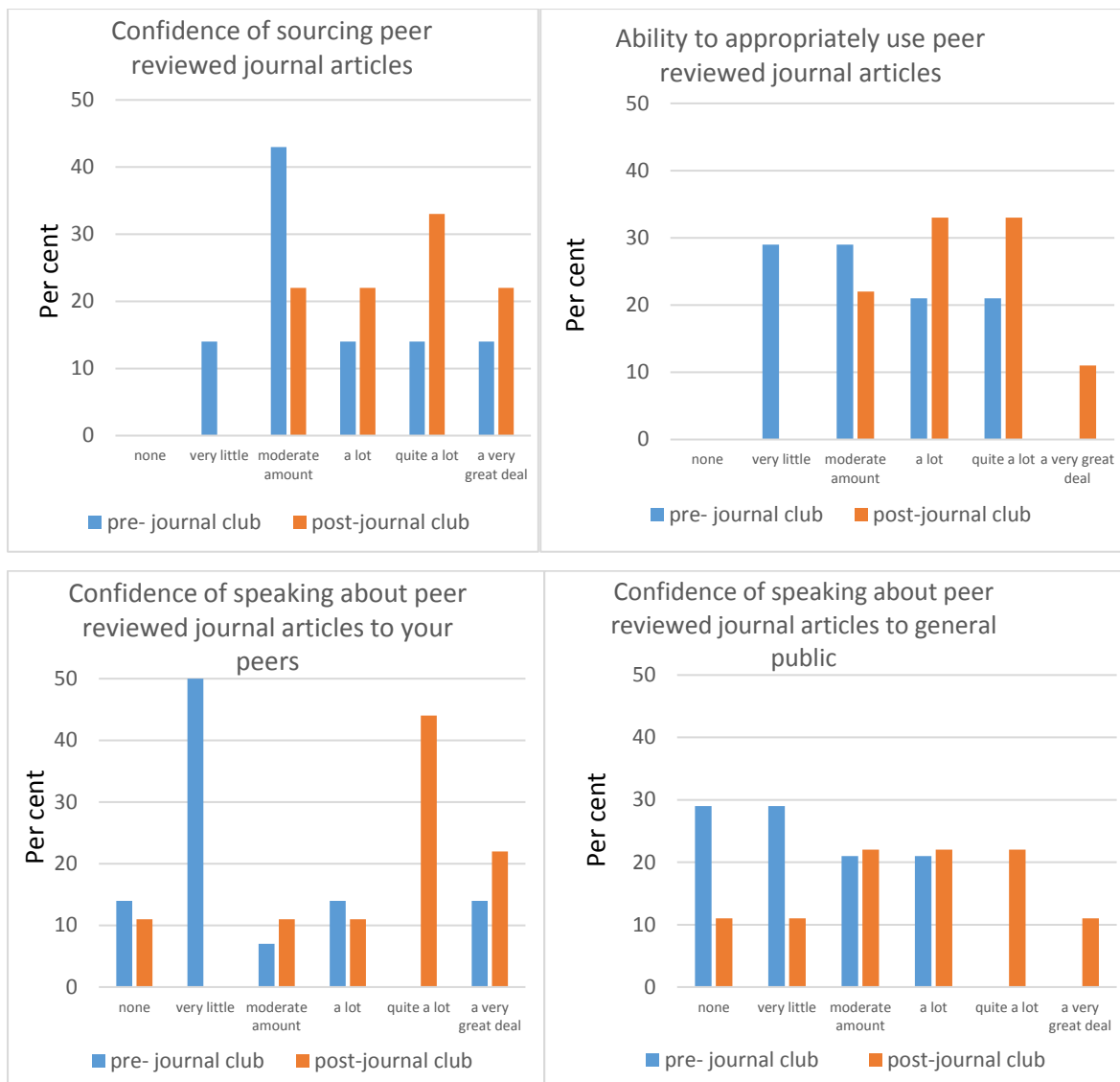


Figure 3.6. Students' rating of their confidence and ability to access, use and communicate a specific type of scientific literature, peer reviewed journal articles, pre- and post- journal club intervention study (Descriptive data from Question 12a, b, c and d, pre-journal club and post-journal club survey questionnaire see Appendix 12).

These findings would imply that other skills required to be demonstrated by graduates of science programmes, such as communication skills, can be enhanced by the inclusion of a journal club as an engagement methodology. The above findings are supported, in principle, by numerous articles on the use of journal clubs as a tool for increasing critical analysis and other skills such as leadership, mentoring and lifelong learning in post graduate medical (Hohmann and Tetsworth, 2016; Sanchez-Mendiola et al., 2016; Serghi et al., 2015; Kattan et al., 2014; Bowen et al., 2014; Pato et al., 2013) and nursing (Laaksonen et al., 2013; Baker, 2013; Davis et al., 2014; Lachance, 2014; Whiting, 2015 and Seymour et al., 2003).

This perception of enhancement in students learning experience, by participation in this research, is further substantiated by responses recorded in the final interviews. Interviewees expressed that their use of peer reviewed literature for studying had improved.

'How I interpret them [peer reviewed literature], it helps that way. It was difficult to interpret them before and now it is has helped, pretty much and just how I think on it, or how I would open it and read it has changed. My interpretation of them and their usefulness in research and college work'

Interviewee #1

'...it ties in all the key points that you really want in an essay question. Sometimes it was very hard for me to get those points and sculpt them all together in an essay. And now reading more journals I am kind of understanding more what to actually add in'

Interviewee #3

All interviewees also stated that they would recommend journal clubs as a tool for learning science and is reflected in the comment by Interviewee #2 below.

'Definitely, without a doubt, I, I thought it was very good. I thought it was good to sit down and make and read each of the like eight different journals and go through them all and with them all being on different topics it gave you a bit of understanding for each topic'

Interviewee #2

3.5.4.4 Concluding thoughts on 'Reflection with Discussion'

I had a certain level of confidence in the plan that I had initially created to undertake this research study (Section 3.5.2), however, with the delay in ethical approval I was apprehensive as to whether the students would fully engage in this endeavour due to the timing. Being so close to the end of the winter semester, the research study coincided with students increasing their commitment to part-time work outside campus that became available with the Christmas

shopping season. As such, timing of this journal club was raised as an issue for the participants. Upon reflection, I may have put my own researcher's needs above those of the students and this has ethical implications that have been highlighted previously by work carried out by Maclean and Poole, (2010), Zeni, (1998) and Comer, (2009) in relation to carrying out research using your own students as participants. Nonetheless, I tried to uphold the four underpinning principles of beneficence, non-maleficence, respect for autonomy and justice during this research study.

I allowed the participants, within their self-allocated groups, to decide and choose their own peer reviewed journal article for presentation. They submitted these to myself for vetting. There appeared to be some confusion over the meaning of primary science literature even though this was defined by myself at the outset. Out of the initial eight articles put forward, three had to be returned because they did not fit within the parameters that I had laid out in the initial introductory session. Some were not within the last five years, others were not from highly rated journals. One submission, which was extremely dated, was accepted and this was due to the fact that it was the seminal paper in this knowledge area. I believe this initial task of finding and submitting a relevant article caused stress for the participants that I had not anticipated. Participants also complained about the large volume of supplementary reading which was required to allow for proper understanding of the selected article and for delivery of the same. Deenadayalan et al., (2008) advise that for running successful journal clubs, articles should be chosen by a trained facilitator and not the students themselves; this is reiterated in Whiting (2015). However, as the essence of this research was to encourage and increase engagement with scientific literature, I thought that the sourcing of the articles by the participants themselves would begin this engagement. An introductory component, prior to undertaking this journal club, with focus on the necessary skill set for accessing peer reviewed literature and delivering presentations, could have circumvented this unintentional stress.

The use of a structured review instrument tool to help students in analysing their chosen paper and preparing for presentation was well received. All interviewees were in agreement that this was helpful and allowed for evaluation of scientific literature. Interviewee # 2 implied that my role as a guide and/or facilitator was important in the experience.

'.....and it helped having someone there who was up to date and has a lot of knowledge of the literature to kind of guide you through reading the papers and give you pointers and more or less to say what it was all about'

Interviewee # 2

Both the findings reported by students above are corroborated by other research. Burstein et al., (1996) and Whiting (2015) report that the use of a structured review instrument enhances the value of journal club for participants. Deenadayalan et al., (2008) support the role of an expert facilitator in organising and leading journal clubs.

Total participation did not occur and this is evidenced by Table 3.3. Students who removed themselves from this process did cause issues as all articles were not presented or were partially presented by participants that did attend. This may have led to gaps in knowledge acquisition for unparticipating students and a fragmentation in the flow of research topics chosen. Their removal from the process also impeded the class discussion and this was confirmed by Interviewee #1.

'Maybe if people got a wee bit more involved in it [journal club discussion], it would have went a bit better, but yeah it was it...the way it was talked about, broke it down and made it a lot easier when students would say it in their language rather than maybe a lecturer speaking who has a lot more knowledge than we do. It was good'

Interviewee #1

Students that removed themselves from this voluntary research study, upon verbal recourse, cited that timing and lack of tangible rewards, i.e. summative marks, were influencing factors in their decision not to participate. If a clear assignment brief with appropriate weighting could have been formulated for this task, it may have overcome this obstacle (Bandura, 1977; Macpherson and Owen, 2010) and this should be considered if using this as a teaching intervention in future.

Another component, which may have led unintentionally to students removing themselves from this research study, was that participation was voluntary. It has been cited by many

researchers (Deenadayalan et al., 2008; Whiting, 2015; Lachance, 2014) that, in order for journal club to be successful, it has to be established with mandatory attendance and participation.

From this experience, I have witnessed the need for prior preparation of the student preceding engagement with a journal club process to achieve ‘buy-in’ from all participants. I need to justify or explain why this learning intervention is worthwhile and for the students engaged in this process. I think that I assumed prior knowledge on the part of the students and did not test this before undertaking this research study. Testing a new teaching intervention or carrying out a research study in isolation from the whole semester’s workload may have led to underestimating the students’ workload. Engagement with the teaching team prior to this undertaking would, in hindsight, have been extremely beneficial.

Upon reflection, I also underestimated my own workload at the end of the academic semester. Participating in a part-time Masters programme, carrying a full time teaching load of 18 hours face to face contact with a wide variety of student cohorts led to lack of real time assimilation of the emerging results of the research. In retrospect, it would have been beneficial to have carried out the data analysis for the pre- and post- journal club survey questionnaires prior to conducting the interviews, but in accordance with the students’ feedback, timing was an issue.

After the completion of this research study, using a journal club as a tool to increase engagement with scientific literature in an undergraduate educational environment, I am encouraged that some aspects worked well for students who engaged with the process, but I believe that it needs to be revisited and restructured if repeated.

Section Four: Conclusion and Recommendations

4.1 Conclusion

This research study sought to evaluate the use of a journal club in an undergraduate Bioanalytical science degree, as a method for engaging students with scientific literature, as part of a first cycle of an Action Research project.

The qualitative and descriptive data yielded from this research are that:

- Journal club provides a supportive environment for undergraduate students to engage in a structured, appropriate and positive manner with scientific literature.
- Student's perceived an increase in support and training for sourcing of primary scientific literature from library and scientific databases.
- Students reported increased access to and time spent engaging with essential text book reading for Molecular Biology.
- Students reported increased access to and time spent engaging with peer reviewed journal articles.
- Students reported increased access to and time spent engaging with science specific websites.
- Students perceived an increase in their confidence in sourcing peer reviewed journal articles.
- Students perceived an increase in their ability to use peer reviewed journal articles appropriately in their academic work.
- Student's perceived an increase in their confidence in communicating science with their peers.
- Students perceived an increase in their confidence in communicating science with the general public.

This data, although exploratory in nature, supports the idea that a journal club in an undergraduate setting can facilitate the acquiring of skills that are deemed necessary for science graduates by QQI.

4.2 Recommendations for future use of Journal Clubs in undergraduate science programmes

1. Completion of a second cycle of the action research study using a modified version of the original plan for journal club implementation (Section 3.5.2) where collaboration on article choices is more apparent.
2. An introductory workshop, prior to undertaking this journal club intervention, with targeted revision of the necessary skill set for accessing peer reviewed literature and presentations
3. Consideration of a weighted assignment brief with assessment strategies that allows for summative marks to be attributed to the journal club.

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Appendices

Appendix 1



APPLICATION FORM FOR ETHICAL APPROVAL

INSTRUCTIONS

1. No empirical research should be undertaken prior to ethical approval being granted.
2. Copies of proposed questionnaires or a list of questions to be included in any questionnaire should accompany this application form.
3. All fields should be completed. Where Not Applicable applies, please enter N/A.
4. All researchers must complete Section A and, where applicable, Section B and Section C.
5. Section D will be completed by the Institute Research Ethics Committee n (IREC).
6. Appeals of the Decision of the IREC should be completed in Section E
7. Please email completed form to Researchethics@lyit.ie .
8. **When submitting your form please ensure the Subject Line of your email contains the words “Ethics Application”, followed by your name. |**

SECTION A

Project Title Is Journal Club an appropriate and useful teaching tool for undergraduate biology students?

Date of Submission 30/10/15

Name of all person(s) submitting research proposal
Anne Nelson

Type of Research Taught Masters MSc by Research External Research Funding

Position Student Staff
If student, Student No. L0074356
Programme Title Masters in Teaching and Learning
Name of supervisor Deirdre McClay

Department/Centre Department of Law and Humanities

Email Address anne.nelson@lyit.ie

Name of Principal Researcher (if different from above e.g., Student's Supervisor)

Position Held

Pre-existing approval and Multi-agency research

1. If your research has pre-existing ethics approval please attach the approval and submit directly to researchethics@lyit.ie.
2. If your research is to be carried out across two or more research centres and ethics approval has already been granted by another agency/institution then please attach the approval and submit to researchethics@lyit.ie.

In both instances there is no requirement to complete the remainder of the application form.

SECTION B

1. Describe the purposes of the research proposed.

The researcher proposes to work within an action research framework to assess engagement of undergraduate students with journal club. Students will engage with primary literature in a journal club setting and will be surveyed and interviewed about their experiences. Journal clubs are primarily a post graduate teaching tool, this teaching tool will be trialed at undergraduate level with students completing their level 8 honours degree programme in Bioanalytical Science.

In July 2014, the Quality and Qualifications Ireland (QQI) released an updated awards standards document for the creation of science programmes. It is clearly stated in all of the three learning outcomes of knowledge, skill and competence that the learners (students) have to engage with original (or primary) literature and should have the ability to communicate this scientific information in a variety of forms to specialist and non-specialist audiences (QQI, 2014).

Journal clubs can address both of the above parameters by organised engagement of students with primary literature and the communicating of their findings to their peers. Journal clubs are an internationally recognised and established teaching tool for postgraduate medical students (Alam & Jawaid, 2009, Pato *et al.*, 2013 and Sabaretnam *et al.*, 2014) and recently as a tool for collaborative learning in nursing education (Laaksonen *et al.*, 2013, Baker, 2013 and Davis *et al.*, 2014).

With respect to science education, journal clubs are used to promote 'area' expertise and awareness at post graduate level where often journal club is part of the educational programme attached to doctoral research programmes. However, the use of journal clubs at undergraduate level in science has not been routinely reported through academic papers. Rauschert *et al.*, 2011 reported on a workshop they provided to educators on how to incorporate primary literature into undergraduate curriculum after the publication of the American Association for the Advancement of Science (AAAS) paper in 2011. This AAAS paper is in part reflective of the QQI award standards and suggests that biology students, in addition to learning content, need other core competencies or skills to become successful scientists (AAAS, 2011). All stated competencies can be addressed by using primary literature in a classroom setting, whether these skills are facilitated by journal club at undergraduate level is the focus of this investigation.

2. Please complete the research ethics checklist below:

	YES	NO
a) Does the research involve human or animal participants?	X	<input type="checkbox"/>
b) Does the research involve data of a personal or confidential nature?	X	<input type="checkbox"/>
c) Does the study involve participants who are particularly vulnerable or unable to give informed consent e.g. people under 18, people with learning disabilities, older people, students?	<input type="checkbox"/>	<input type="checkbox"/>
X		
d) Will the study require the co-operation of a gatekeeper for access to participants? (e.g. teacher, local council)	<input type="checkbox"/>	X
e) Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g. covert observation of people in non-public places)	<input type="checkbox"/>	X
f) Will the study involve discussion of sensitive topics (e.g. sexual activity, drug use)?	<input type="checkbox"/>	X
g) Are there issues of safety for the researchers or subjects, aside from those documented in Institute or Departmental Health and Safety procedures?	<input type="checkbox"/>	X
h) Could the study induce psychological stress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life?	<input type="checkbox"/>	X
i) Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?	<input type="checkbox"/>	X
j) Does the research involve a conflict of interests?	<input type="checkbox"/>	X

If you have answered 'NO' to all of the questions above there is no requirement to complete the remainder of the form. Please submit to researchethics@lyit.ie

If you have answered 'yes' to questions (c) please continue and complete the remainder of the application form submit to researchethics@lyit.ie

SECTION C

3. Please give a summary of the design and methodology of the project. **Please note** that copies of proposed questionnaires or a list of questions that will be included in any questionnaire should accompany this application form (Compulsory not optional). Please also include in this section details of the proposed sample size, giving indications of the calculations used to determine the required sample size, including any assumptions you may have made. (If in doubt, please obtain statistical advice).

The researcher proposes to work within an action research framework to assess engagement of undergraduate students with journal club. Data collection will be undertaken using surveys and interviews and qualitative analysis of found themes will be carried out.

The researcher proposes to work with, self volunteered, level 8 students on the B.Sc in Bioanalytical Sciences programme at Letterkenny Institute of Technology. The expected size of research cohort is approximately 12-15 students. The researcher will endeavour to trial a recognised post graduate teaching tool (journal club) in an undergraduate setting. This is a teaching and learning exercise that will look at qualitative data formulated from before and after surveys of the participants. The surveys will focus on engagement and look for themes that may arise. Interviews will be carried out with approximately 6 volunteers, upon completion, to assess how they perceived their learning experience within this research exercise.

An indicative survey questionnaire for this research is included in appendix A
All references cited in Section B, 2 are included in appendix B

4. Describe the research procedures as they affect the research subject and any other parties involved.

The student cohort that will be approached to participate in this study will have previously been encouraged to engage with primary literature as part of the module that is being taught by the researcher. However, the self volunteered participants will have an extra workload and time commitment, independent of the module and non participating students, in that they must read, assimilate and present peer reviewed scientific research papers to the participants of the research group. There are no other parties involved.

5. What in your opinion are the ethical considerations involved in this proposal? (You may wish for example to comment on issues to do with consent, confidentiality, risk to subjects, etc.)

The student cohorts that are to be invited to take place in this research come from the researchers own teaching classes. They must be explicitly informed that participation is not mandatory and that their choice will not impinge on any marks achieved in assessments that may be carried out by the researcher within the assigned teaching modules. However, consideration must be given to the fact that the learning achieved by the participants may increase their own learning skillset and knowledge base and as such they may become engaged with primary literature and current findings in research over and above their non participating peers.
Data will be collected through both surveys and interviews, the participants will need to be informed that the data will be held confidentially but will be anonymised for use in the research findings and will be viewed by others in this format.

6. Outline the reasons which lead you to be satisfied that the possible benefits to be gained from the project justify any risks or discomforts involved.

From my professional experience to date, science graduates need to engage with original (or primary) literature and should have the ability to communicate this scientific information in a variety of forms to specialist and non-specialist audiences. By participating in this research, students will gain a better understanding on how to access, critique and present such material. It may enthuse the learner to engage in further skills that will help them undertake a lifelong learning process with respect to their discipline area and to continuously develop at a professional level.

7. Who are the investigators (including assistants) who will conduct the research and what are their qualifications and experience?

The sole investigator will be Anne Nelson who is presently employed as a Lecturer in the Department of Science at Letterkenny Institute of Technology. Anne graduated with Ph.D in Biochemistry and Molecular Biology and B.Sc. (Hons) in Biochemistry from NUI-G. She has a Diploma in the Psychology of Counselling from NUI-G and also a Diploma (level 9) in Training and Education from Griffith College Dublin. Anne has worked as a lecturer and science researcher for numerous years both in Ireland and the USA.

8. Are arrangements for the provision of clinical facilities to handle emergencies necessary? If so, briefly describe the arrangements made.

N/A

9. In cases where subjects will be identified from information held by another party (for example, a doctor or hospital) describe the arrangements you intend to make to gain access to this information including, where appropriate, which Multi Centre Research Ethics Committee or Local Research Ethics Committee will be applied to.

N/A

10. Specify whether subjects will include students or others in a dependent relationship.

The research will be undertaken with self volunteered students from the level 8 B.Sc. in Bioanalytical Science programme, who will be undertaking a module in Molecular Biology with the researcher. They will be informed that their participation, or lack of, in the research study will not impinge upon their final grades.

11. Specify whether the research will include children or people with mental illness, disability or handicap. If so, please explain the necessity of involving these individuals as research subjects.

N/A

12. Will payment or any other incentive, such as a gift or free services, be made to any research subject? If so, please specify and state the level of payment to be made and/or the source of the funds/gift/free service to be used. Please explain the justification for offering payment or other incentive.

N/A

13. Please give details of how consent is to be obtained. A copy of the proposed consent form, along with a separate information sheet, written in simple, non-technical language **MUST** accompany this form.

It is proposed that the self volunteered participants will be given information with respect to the research being undertaken and from this knowledge will sign consent forms showing understanding of the research and their participation in it. A copy of the proposed information sheet and consent form are included in appendix C.

14. Comment on any cultural, social or gender-based characteristics of the subject which have affected the design of the project or which may affect its conduct.

The participants involved, are self volunteered level 8 B.Sc (Hons) in Bioanalytical Sciences students who have already graduated with a B.Sc in Bioscience or B.Sc. in Analytical and Forensic Science. As they are graduates, the expectation is that they will have a previously developed skillset to help support their engagement with this research. There are no particular characteristics, that the researcher is presently aware of, that will be affected.

15. Please state who will have access to the data and what measures which will be adopted to maintain the confidentiality of the research subject and to comply with data protection requirements e.g. will the data be anonymised?

All data gathered will be stored securely so that data cannot be accessed, altered, disclosed or destroyed by unauthorised persons. It can be accessed only by the principal researcher Anne Nelson and upon request from her supervisor. The data will be maintained on Anne's computer which has a password protected screen saver. The computer software is updated regularly and it contains Norton Antivirus software which is set for daily automatic updating. In addition to the antivirus software, a firewall also runs on the computer. All documents are password protected.

16. Will the intended group of research subjects, to your knowledge, be involved in other research? If so, please justify.

I am unaware of these students being involved in other research.

17. Date on which the project will begin and end.

The research will begin once ethical clearance has been obtained. The project must be submitted by 31st August 2016.

18. Please state location(s) where the project will be carried out.

Letterkenny Institute of Technology

19. Please state briefly any precautions being taken to protect the health and safety of researchers and others associated with the project (as distinct from the research subjects) e.g. where blood samples are being taken

N/A

20. Please specify how any data obtained during the course of the research will be stored and how long the data will be retained for.

All data gathered will be stored securely so that data cannot be accessed, altered, disclosed or destroyed by unauthorised persons. International best practice requires that all research data should be stored for several years. The general recommendation is that there is secure retention of anonymised data for 5 years after the completion of the study, this will be followed in this study.

DECLARATION

Researcher

I confirm I will carry out the research as indicated in the above form

Research Supervisor

I confirm that this form gives an accurate account of the proposed research

SECTION D

For office use only

INSTITUTE RESEARCH ETHICS COMMITTEE

DATE:

DECISION

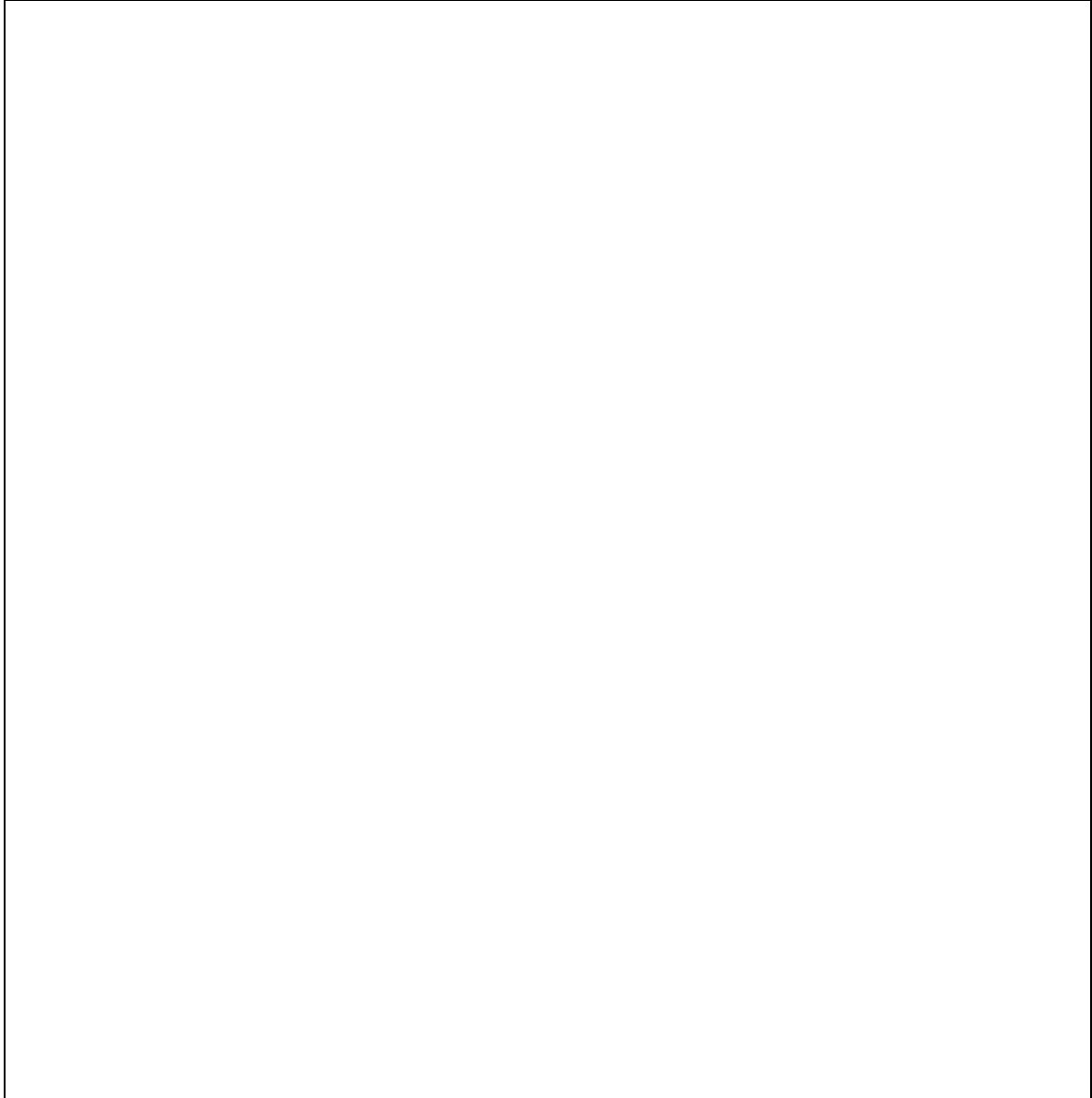
- 1. Approved without amendment
- 2. Approved subject to minor modifications
(No resubmission required, supervisor responsible for ensuring that modifications are implemented)
- 3. Modifications required. Complete modifications below and resubmit.
- 4. Additional information required.
- 5. Approval withheld. All conditions set by Institute Research Ethics Committee must be met.
- 6. Reject.

REASONS FOR DECISION

SECTION E

APPEAL

Please outline in detail the reasons why you are appealing the decision of the Institute Research Ethics Committee.

A large, empty rectangular box with a thin black border, intended for the user to write their appeal. It occupies the majority of the page's vertical space below the instructions.

Appendix A

Indicative survey questionnaire for students

Structure for Questionnaire

1. Gender M / F Dichotomous, Nominal
To ensure that all genders are accounted for. There may be some anomaly or link that might have to be explored
2. Primary degree/Qualification Multiple Choice, single answer, Nominal
Bands of B.Sc. award grades from pass to distinction. Must give possibility for NA for mature student entry and to accommodate other learners.
3. Participation in sourcing primary scientific literature Yes / No, Dichotomous, Nominal

Branching question to determine those who have or haven't a prior experience of sourcing primary scientific literature. If Yes go to question 4. If No go to question 5
4. If answer yes
Open question about the fears, experience and knowledge of the participant.
Proceed to question 6.
5. If answer No
Open question about any fears, expectations and experiences the participant may have. Proceed to question 6.
6. Matrix Question - Institutional, Likert scale, Ordinal data, 6 choices
Rate learning support mechanisms, training
7. Matrix Question - Student, Likert scale, Ordinal data, 6 choices
Rate Confidence levels, fears, expectations, barriers

Indicative Questionnaire

1. Please circle your gender: Male / Female
2. Please put a tick in the box that best matches your primary degree award grade or other equivalent prior education award

Pass	Merit 2	Merit 1	Distinction	N/A
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Do you have previous experience of sourcing primary science literature (Please circle)?
Yes / No

If you answered "Yes" to question 3, please go to question 4.
If you answered "No" to question 3, please go to question 5.

4. Please complete the following and then go to question 6:
The main things I found difficult about sourcing primary scientific literature are

.....
.....
.....
.....
.....
.....

5. Please complete the following and then go to question 6:
I do not have experience of sourcing primary scientific literature because

.....
.....
.....
.....
.....
.....

6. This question relates to your experience(s) of the support and training you have received in the use of sourcing primary scientific literature as graduate students in the School of Science. Please complete the following by placing a tick in one space only, as follows:

1 = none; 2 = very little; 3 = moderate amount; 4 = a lot; 5 = quite a lot; 6 = a very great deal

In your opinion what level of support and training has the School of Science provided in the following areas?

	1	2	3	4	5
6					
a General Library use for research [] []		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Scientific Database searching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Appropriate use of scientific literature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Harvard UL Referencing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. This question relates to your experience(s) using **primary science literature** as a student in the School of Science. Please complete the following by placing a tick in one space only, as follows:

1 = none; 2 = very little; 3 = moderate amount; 4 = a lot; 5 = quite a lot; 6 = a very great deal

Tell me about the following?

	1	2	3	4	5
6					
a Your confidence of sourcing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Your ability to appropriately use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Your confidence of speaking about []		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Your engagement with	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Thank you for your participation and cooperation in this research. Yours responses will be kept confidential. Please scan your answers and complete any questions that you may have left out. I will present an overview of the results of this study to inform you about some of the findings.

Appendix B

References

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Appendix C



lyit

Institiúid
Teicneolaíochta
Leitir Ceanainn

Letterkenny
Institute
of Technology

Participant Information Sheet

Study title: Is Journal Club an appropriate and useful teaching tool for undergraduate biology students?

Researcher: Dr. Anne Nelson School of Science

'You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this'.

What is the purpose of the study?

This study is intended to provide an insight into the usefulness of journal club in promoting engagement with science literature in undergraduate students. Journal club is a post graduate teaching tool for medical and scientific research students. It is an environment where peers share their research on a scientific area with each other. The study is an integral component of the research being conducted for a Masters in Teaching and Learning by Anne Nelson.

Why have I been chosen?

The study focuses on the level 8 students that have completed a Level 7 degree or equivalent in science.

Do I have to take part?

Participation in the research is entirely voluntary. Students will be encouraged to participate because the outcomes of the research may help future students. However, any student who decides not to participate will not be disadvantaged in any way. Your grades and assessments will not be affected whether you decide to participate or not. You may also withdraw from the research at any time.

What will happen to me if I take part?

If you decide to participate you will be asked to give your consent. The consent is necessary to allow the collection of data from survey questionnaires and interviews. All consenting participants will participate in completing a short questionnaire at the beginning of the process and the end of the research. It should take approximately 15 minutes to complete. All consenting participants will be required to commit to one hour a week to meet for journal club and will be asked to work in a small group to present their findings on a chosen paper. A small sample of participants will be selected to take part in interviews at the end of the research. The interviews should not last more than 30 minutes.

Will my taking part in this study be kept confidential?

All survey questionnaires will be completed and collected without any means of identifying participants. Interview participants will be recorded on audio tape. The audio material will be stored in a secure location and all names will be replaced with pseudo names to ensure privacy and confidentiality. The audio recordings and questionnaires will be destroyed upon completion of the research. All data gathered will be stored securely so that data cannot be accessed, altered, disclosed or destroyed by unauthorised persons. The data will be maintained on researcher's computer which has a password protected screen saver. The computer software is updated regularly and it contains Norton Antivirus software which is set for daily automatic updating. In addition to the antivirus software, a firewall also runs on the computer. All documents are password protected.

Please note that assurances on confidentiality will be strictly adhered to unless evidence of wrongdoing or potential harm is uncovered. In such cases the College may be obliged to contact relevant statutory bodies/agencies.

What will happen to the results of the research study?

The results of the research study will be used to support the submission of a thesis for taught Masters. The results may also be used in publications of the research in research journals and conferences. Participants will not be identified in any published report.

Who is organising and funding the research? (If relevant)

The research is supported by the School of Science, Letterkenny Institute of Technology.

Who has reviewed the study?

The project has been reviewed by Letterkenny Institute of Technology Research Ethics Committee.

Contact for Further Information

Primary Contact: Anne Nelson, School of Science – email: anne.nelson@lyit.ie

Secondary Contact: Anne Burke, Head of Department in Law and Humanities – email: anne.burke@lyit.ie



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Letterkenny
Institute
of Technology

Consent Form

Title of Project: Is Journal Club an appropriate and useful teaching tool for undergraduate biology students?

Name of Researcher: Anne Nelson

Participants: B.Sc (Hons) in Bioanalytical Science

- I confirm that I have read and understand the Plain Language Statement for the above study and have had the opportunity to ask questions.
- I understand that my participation is voluntary and that I am free to withdraw at any time up until data is collected, without giving any reason, by sending an email to anne.nelson@lyit.ie
- I give my consent to be surveyed, if requested
- I give my consent to be interviewed and audio-taped, if requested.
- I give my consent that any research publication reference to my participation in completing any questionnaire, participation in any interview or focus group will be by means of a pseudonym.
- I understand that my participation or non-participation in the research will have no effect on grades or assessment.
- I agree to take part in the above study.

Participant's Name: _____

Student Number: _____

Signature: _____

Date: _____

I, the researcher, have stated the purpose and procedure involved in this piece of research. I have answered any questions that the participant had in relation to the study and I am satisfied. I believe the participant has understood my explanation and purpose of this study and has given me informed consent.

Researcher's signature: _____ Date: _____

For further information contact:

Primary Contact: Anne Nelson, School of Science – email: anne.nelson@lyit.ie

Secondary Contact: Anne Burke, Head of Department in Law and Humanities – email: anne.burke@lyit.ie

Appendix 2

Module Title: Molecular Biology

Module Code:
Credits: 10
Credit Level: 8
Prerequisite Modules: None

Timetabled Hours per Week	
Lectures	3
Tutorials	
Lab/Studio/Practicals	4
Independent Learning	6
Total	13

Description:

This module aims to expand on a basic knowledge of recombinant DNA technology and provide a more in-depth understanding of advances in molecular methods. The module also aims to develop laboratory skills in the manipulation of nucleic acids and proteins.

Module Learning Outcomes:

On successful completion of this module the learner will be able to:

1. Critically evaluate current methods in molecular biology.
2. Describe the principles and appraise the application of genomics analysis.
3. Evaluate bioinformatics as a tool to aid in the investigation of nucleic acids and proteins.
4. Demonstrate laboratory skills in manipulation of nucleic acids and proteins.
5. Examine the data produced in laboratory experiments and critically analyse.
6. Develop experimental strategies.

Indicative Content:

- Fundamentals of Recombinant DNA Technology**
 - Review of DNA structure and function
 - Nucleic Acid manipulation and cloning
 - Eukaryotic Gene Regulation
- Advances in Molecular Biology**
 - Advances in Molecular Biology Techniques
 - Advances in PCR based Technology
 - Gene transfer in animal cells
 - Genomics
 - Bioinformatics
- Laboratory manipulation of nucleic acids and proteins**
 - Isolation, manipulation and analysis of nucleic acids
 - Isolation, manipulation and analysis of proteins

Module Assessment:

Coursework	40%
End of Semester Final Exam	60%

Learning Outcome	Addressed by	
	Coursework	End of Semester Final Exam
1	X	X
2	X	X
3	X	X
4	X	
5	X	
6	X	

Coursework may comprise a mix of assessment approaches, such as: reports, practicals, presentations, portfolios, class tests, quizzes, group work and integrated assessment. Details of the nature of assessment and submission dates are contained in the annual Programme Assessment Schedule.

End of Semester Final Examination

The final written examination will be **3** hours in duration. It will comprise **6** questions of which the learner should attempt **4** questions.

Resources:

Note: Learning resources may also be available on Blackboard.

Essential Reading				
Author	Year	Title	Publisher	ISBN
Dale, J. & von Schantz, M and Plant, N.	2012	From Genes to Genomes Concepts and Applications of DNA Technology	Wiley-Blackwell	9780470683859
Brown, T.	2010	Gene Cloning and DNA Analysis: An Introduction	Wiley-Blackwell	1405181737
Supplementary Reading:				
Lodish H, Berk A, Kaiser CA, Krieger M, Scott MP, Bretscher A, Ploegh H, Matsudaira P.	2007	Molecular Cell Biology	W. H. Freeman	1429203145
Rapley R and Harbron S	2010	Molecular Analysis and Genome Discovery	Wiley-Blackwell	0470758775

Other Resources

<http://sciencedirect.com>

http://library1.lyit.ie/screens/science_db.html

<http://www.ncbi.nlm.nih.gov/>

Appendix 3



Study title: Is Journal Club an appropriate and useful teaching tool for undergraduate biology students?

Researcher: Dr Anne Nelson, School of Science

'You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve, Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this'.

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The study focuses on the level 8 students that have completed a Level 7 degree or equivalent in science.

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Participation in the research is entirely voluntary. Students will be encouraged to participate because the outcomes of the research may help future students. However, any student who decides not to participate will not be disadvantaged in any way. Your grades and assessments will not be affected whether you decide to participate or not. You may also withdraw from the research at any time.

What will happen to me if I take part?

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Will my taking part in this study be kept confidential?

All survey questionnaires will be completed and collected without any means of identifying participants. Interview participants will be recorded on audio tape. The audio material will be stored in a secure location and all names will be replaced with pseudo names to ensure privacy and confidentiality. The audio recordings and questionnaires will be destroyed upon completion of the research. All data gathered will be stored securely so that data cannot be accessed, altered, disclosed or destroyed by unauthorised persons. The data will be maintained on researcher's computer which has a password protected screen saver. The computer software is updated regularly and it contains Norton Antivirus software which is set for daily automatic updating. In addition to the antivirus software, a firewall also runs on the computer. All documents are password protected.

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What will happen to the results of the research study?

The results of the research study will be used to support the submission of a thesis for taught Masters. The results may also be used in publications of the research in research journals and conferences. Participants will not be identified in any published report.

Who is organising and funding the research? (If relevant)

The research is supported by the School of Science, Letterkenny Institute of Technology.

Who has reviewed the study?

The project has been reviewed by Letterkenny Institute of Technology Research Ethics Committee.

Contact for Further Information

Primary Contact: Anne Nelson, School of Science — [email: anne.nelson@lyit.ie](mailto:anne.nelson@lyit.ie)

Secondary Contact: Anne Burke, Head of Department in Law and Humanities — [email: anne.burke@lyit.ie](mailto:anne.burke@lyit.ie)

Appendix 4



Consent Form

Title of Project: Is Journal Club an appropriate and useful teaching tool for undergraduate biology students?

Name of Researcher: Anne Nelson

Participants: B.Sc. (Hons) in Bioanalytical Science

- I confirm that I have read and understand the Plain Language Statement for the above study and have had the opportunity to ask questions.
- I understand that my participation is voluntary and that I am free to withdraw at any time up until data is collected, without giving any reason, by sending an email to anne.nelson@lyit.ie
- I give my consent to be surveyed, if requested
- I give my consent to be interviewed and audio-taped, if requested.
- I give my consent that any research publication reference to my participation in completing any questionnaire, participation in any interview or focus group will be by means of a pseudonym.
- I understand that my participation or non-participation in the research will have no effect on grades or assessment.
- I agree to take part in the above study.

Participant's Name: _____

Student Number: _____

Signature: _____

Date:

I, the researcher, have stated the purpose and procedure involved in this piece of research. I have answered any questions ~~that the participant had in relation to the study and~~ I am satisfied. I believe the participant has understood my explanation and purpose of this study and has given me informed consent.

Researcher's signature: _____ Date: _____

For further information contact:

Primary Contact: Anne Nelson, School of Science — [email: anne.nelson@lyit.ie](mailto:anne.nelson@lyit.ie)

Secondary Contact: Anne Burke, Head of Department in Law and Humanities — [email: anne.burke@lyit.ie](mailto:anne.burke@lyit.ie)

Appendix 5

Questionnaire

1. Please circle your gender: Male / Female
2. Please put a tick in the box that best matches your primary degree award grade or other equivalent prior education award

Pass	Merit 2	Merit 1	Distinction	N/A
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Do you have access to the 'essential reading' recommended for Molecular Biology module as indicated on the Module Descriptor (Please circle)? Yes / No

If you answered "Yes" to question 3, please go to question 4.
If you answered "No" to question 3, please go to question 5.

4. Please complete the following and then go to question 6:

I purchased a 'hard' copy/copies of the recommended essential reading text books Yes / No
I purchased an 'e- copy/copies' of the recommended essential reading text books Yes / No
I accessed the books through the Lyit library Yes / No
If other sources were used please indicate here

.....

.....

5. Please complete the following and then go to question 6:

I do not have access to the recommended essential reading because

.....

.....

6. Do you have previous experience of sourcing peer reviewed journal articles (Please circle)? Yes / No

If you answered "Yes" to question 6, please go to question 7.
If you answered "No" to question 6, please go to question 8.

7. Please complete the following and then go to question 9:

The main things I found straight forward and/or difficult about sourcing peer reviewed journal articles are

.....

.....

.....

8. Please complete the following and then go to question 9:

I do not have experience of sourcing peer reviewed journal articles literature because

.....

.....

.....

9. This question relates to your experience(s) of the support and training you have received in the use of sourcing primary scientific literature as students in the School of Science or elsewhere. Please complete the following by placing a tick in one space only, as follows:

1 = none; 2 = very little; 3 = moderate amount; 4 = a lot; 5 = quite a lot; 6 = a very great deal

In your opinion what level of support and training has the School of Science provided in the following areas?

		1	2	3	4	5	6
a	General Library use for research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b	Scientific Database searching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c	Appropriate use of scientific literature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d	Harvard UL Referencing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. This question relates to your experience(s) accessing **primary science literature** as a student in the School of Science. Please complete the following by placing a tick in one space only, as follows:

1 = none; 2 = very little; 3 = moderate amount; 4 = a lot; 5 = quite a lot; 6 = a very great deal

In relation to primary science literature how often have you accessed?

		1	2	3	4	5	6
a	Recommended essential reading text books	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b	Recommended supplementary reading text books	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c	Peer reviewed journal articles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d	Science Specific Websites e.g. ScienceDaily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. This question relates to your time spent interacting with **primary science literature** as a student in the School of Science. Please complete the following by placing a tick in one space only, as follows:

1 = ≤ 1 hr; 2 = ≤2-3 hrs; 3 = ≤4-5 hrs; 4 = ≤5-6 hrs; 5 = ≤6-8 hrs; 6 = ≥8 hrs

How much time do you spend reading primary science literature per week?

		1	2	3	4	5	6
a	Recommended essential reading text books	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b	Recommended supplementary reading text books	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c	Peer reviewed journal articles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d	Science Specific Websites e.g. ScienceDaily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. This question relates to your experience(s) using **primary science literature** as a student in the School of Science. Please complete the following by placing a tick in one space only, as follows:

1 = none; 2 = very little; 3 = moderate amount; 4 = a lot; 5 = quite a lot; 6 = a very great deal

In relation to primary science literature how do you rate?

		1	2	3	4	5	6
a	Your confidence of sourcing peer reviewed journal articles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b	Your ability to appropriately use peer reviewed journal article in your work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c	Your confidence of speaking about peer reviewed journal articles to your peers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d	Your confidence of speaking about peer reviewed journal articles to the general public	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix 6

Raw Data from pre- and post- journal club questionnaires. R# = Respondent number

Pre-journal club

pre-journal club	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
Q1																
Male	1	1												1	3	21
Female			1	1	1	1	1	1	1	1	1	1	1		11	79

Q2	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
Pass (40-50%)						1			1	1				1	4	29
Merit 2 (50-60%)	1						1					1	1		4	29
Merit 1 (60-70%)				1	1			1			1				4	29
Distinction (>70%)		1	1												2	14
N/A																0
Q3	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	100
No															0	

Q4	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
a																
Yes															0	0
No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	100
b																
Yes			1			1						1	1		4	29
No	1	1		1	1		1	1	1	1	1			1	10	71
c																
Yes	1	1	1		1	1	1	1	1	1	1	1	1	1	13	93
No				1											1	7
COMMENT	N	Y	N	Y	Y	N	N	Y	Y	N	N	N	N	N	N	0

R2: Books were downloaded as torrent file, all essential reading

R4: It was downloaded free

R5: Free download

R8: Some chapters of the books are available on line

R9: Google scholar

Q5	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
COMMENT	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	

Q6	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	100
No															0	0

Q7	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
COMMENT	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		0

R1: The main difficulty would be that some articles have to be purchased.

R2: Access through LYIT is convenient

Some abstracts use so many acronyms to the point it doesn't read well, difficult to grasp

Introductions is much closer related to normal communications much easier way to read a paper for me.

R3: Difficult: understanding some of technical info

Understanding what journals provide good info and what are useless

Easy: Access through library was straight forward

R4: A lot of the access is restricted. Very specific wording of searches

R7: Accessing the paper (i.e. purchase) difficult. There are a lot of options to filter areas (positive). Sometimes the terminology is hard to grasp so papers need to be read a number of times

R6: Accessing the journals could sometimes be difficult as they sometimes had to be purchased. The websites are simple to work so it is easy to find sources for journals

R7: Accessing the journals can be difficult as some you have to purchase. The filter options are straight forward

R8: I often find that the exact keywords do not generate the type of article I'm looking for. I find a google search of the term instead or using a source like science direct can bring up more relevant articles from recognised journals

R9: Some only give access to abstracts

R10: clearly written with great relevant information to topic with proof and evidence of data and research.

R11: Access

R12: I found sourcing peer reviewed journals straight forward via sources such as science direct. The "refine search" feature was useful in sourcing content I needed from the years I wanted.

R13: It is difficult to find valid information. It is difficult to decipher between useful information and the information that has not been proven or peer reviewed

R14: Science direct is easy to use

Q8	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
COMMENT	N	N	N	N	N	N	N	N	N	N	N	N	N	N		0

Q9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
a1															0	0

a2		1	1	1				1						4	29	
a3	1									1			1	3	21	
a4					1							1	1	3	21	
a5						1	1				1			3	21	
a6									1					1	7	
b1														0	0	
b2		1	1	1										3	21	
b3	1													1	7	
b4					1		1				1	1	1	5	36	
b5						1			1	1				1	4	29
b6								1						1	7	
c1														0	0	
c2					1									1	7	
c3	1	1	1											3	21	
c4					1	1					1		1	1	5	36
c5							1	1		1		1		4	29	
c6									1					1	7	
d1														0	0	
d2											1			1	7	
d3					1	1								2	14	
d4	1	1	1			1	1						1	6	43	
d5												1		1	2	14
d6									1	1		1		3	21	

Q10	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
a1				1											1	7
a2							1					1			2	14
a3	1				1	1				1				1	5	36
a4								1	1		1				3	21
a5			1										1		2	14

a6		1													1	7
b1				1											1	7
b2	1				1		1	1						1	5	36
b3						1				1	1	1			4	29
b4									1						1	7
b5		1	1										1		3	21
b6															0	0
c1															0	0
c2					1										1	7
c3	1					1	1						1		4	29
c4						1					1	1			4	29
c5			1							1			1		3	21
c6				1						1					2	14
d1					1	1	1	1							4	29
d2													1		1	7
d3	1													1	2	14
d4					1						1				3	21
d5											1		1		2	14
d6			1							1					2	14

Q11	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
a1											1				1	7
a2	1					1	1	1			1		1	1	8	57
a3			1	1						1					3	21
a4															0	0
a5										1					1	7
a6						1									1	7
b1			1							1			1	1	5	36
b2	1			1	1	1	1				1		1		8	57
b3										1					1	7

b4															0	0
b5															0	0
b6															0	0
c1						1									1	7
c2	1				1		1								3	21
c3										1	1		1		3	21
c4															0	0
c5		1	1					1	1			1		1	6	43
c6				1											1	7
d1					1	1	1								3	21
d2	1										1		1		3	21
d3														1	1	7
d4			1	1											2	14
d5		1						1		1		1			4	29
d6									1						1	7

Q12	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	TOTALS	%
a1															0	0
a2				1									1		2	14
a3	1				1	1	1			1	1				6	43
a4												1		1	2	14
a5								1	1						2	14
a6		1	1												2	14
b1															0	0
b2				1		1	1						1		4	29
b3	1				1					1				1	4	29
b4								1			1	1			3	21
b5		1	1						1						3	21
b6															0	0
c1						1	1								2	14

c2	1			1	1			1		1	1			1	7	50
c3													1		1	7
c4			1										1		2	14
c5															0	0
c6		1							1						2	14
d1	1					1	1	1							4	29
d2				1	1								1	1	4	29
d3		1								1	1				3	21
d4			1						1				1		3	21
d5															0	0
d6															0	0

Post-journal club

post-journal club	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
Q1											
Male						1			1	2	22
Female	1	1	1	1	1		1			7	78

Q2	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
Pass (40-50%)			1					1		2	22
Merit 2 (50-60%)				1	1	1				3	33
Merit 1 (60-70%)	1	1								2	22
Distinction (>70%)							1		1	2	22
N/A										0	0

Q3	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
Yes	1	1	1	1	1	1	1	1	1	9	100
No										0	0

Q4	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
a											
Yes										0	0
No	1	1	1	1	1	1	1	1	1	9	100
b											
Yes	1			1	1		1	1		5	56
No		1	1			1				3	33
c											
Yes	1	1	1	1	1		1	1		7	78
No						1				1	11
COMMENTS	N	N	N	N	N	Y	N	Y	Y		

R6: internet

R8: Papers advised from lecturer

R9: Torrent downloads

Q5	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
COMMENTS	N	N	N	N	N	N	N	N	N		0

Q6	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
Yes	1	1	1	1	1		1	1	1	8	89
No						1				1	11

Q7	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
COMMENTS	Y	Y	Y	Y	Y	N	Y	Y	Y		

R1: Difficult: The paper may be lacking in detail in some aspects or the topic so that you may need additional resources to thoroughly understand the paper

R2: The ability to notice each journal and their rating is now understood. Difficult as some must be purchased.

R3: Relevant materials are for sale (difficult) Easy to access EBSCO and Science Direct

R4: I have found that I was able to access many journal articles from many different sources but I found it difficult to filter through papers that may be irrelevant

R5: Finding information that is reputable. How to know which information is useful and citable and what isn't.

R7: The sheer amount of papers, deciphering these has become easier through this task

R8: Difficulties were great amount of detail and information from many papers into one (*review?/*)

R9: Advantages/Straight forward: access to scientific databases

Disadvantages/difficult: how to understand language.....In depth study of unknown concepts

Q8	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
COMMENTS	N	N	N	N	N	Y	N	N	N		0

R6: Because it was not emphasised before now

Q9	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
a1										0	0
a2										0	0
a3	1						1			2	22
a4		1		1	1				1	4	44
a5						1		1		2	22
a6			1							1	11
b1										0	0
b2										0	0
b3		1								1	11
b4			1	1	1	1		1	1	6	67
b5							1			1	11
b6	1									1	11
c1										0	0
c2										0	0
c3								1		1	11
c4		1	1	1	1					4	44
c5						1	1		1	3	33
c6	1									1	11

d1										0	0
d2										0	0
d3					1			1		2	22
d4		1		1		1	1			4	44
d5									1	1	11
d6	1		1							2	22

Q10	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
a1										0	0
a2						1				1	11
a3								1		1	11
a4	1	1		1	1					4	44
a5			1				1			2	22
a6									1	1	11
b1										0	0
b2				1		1				2	22
b3	1	1			1			1		4	44
b4							1			1	11
b5									1	1	11
b6			1							1	11
c1										0	0
c2										0	0
c3		1			1			1		3	33
c4										0	0
c5			1			1			1	3	33
c6	1			1			1			3	33
d1										0	0
d2										0	0
d3					1					1	11
d4										0	0

d5		1	1						1	3	33
d6	1			1		1	1	1		5	56

Q11	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
a1						1				1	11
a2	1	1			1			1		4	44
a3									1	1	11
a4			1	1						2	22
a5							1			1	11
a6										0	0
b1	1				1	1			1	4	44
b2		1					1	1		3	33
b3				1						1	11
b4			1							1	11
b5										0	0
b6										0	0
c1										0	0
c2										0	0
c3		1			1			1	1	4	44
c4	1									1	11
c5			1	1		1				3	33
c6							1			1	11
d1									1	1	11
d2					1					1	11
d3		1								1	11
d4							1			1	11
d5			1	1		1				3	33
d6	1							1		2	22

Q12	R1	R2	R3	R4	R5	R6	R7	R8	R9	TOTALS	%
a1										0	0
a2										0	0
a3					1			1		2	22
a4		1	1							2	22
a5	1					1			1	3	33
a6				1			1			2	22
b1										0	0
b2										0	0
b3	1				1					2	22
b4		1						1	1	3	33
b5			1	1		1				3	33
b6							1			1	11
c1	1									1	11
c2										0	0
c3								1		1	11
c4					1					1	11
c5		1				1	1		1	4	44
c6			1	1						2	22
d1	1									1	11
d2								1		1	11
d3					1				1	2	22
d4		1		1						2	22
d5						1	1			2	22
d6			1							1	11

Appendix 7

Interviewee #1

17th December 2015, time 10.45 and we are about to start the interview.

The interview is in with respect to a research module that I am undertaking for the masters in learning and teaching within LYIT. Basically you have participated in a journal club [Yip] and we are looking to see whether a journal club is a good teaching tool to engage students with primary literature or secondary literature. Amm Please be assured that this is completely confidential [Yhmm] all data will be stored appropriately in encrypted computers and in locked filing cabinets [Yhmm], and that you are able to stop this interview at any time by saying stop. If you feel uncomfortable going ahead. Amm The amount of time will probably take 10 minutes [Hmm]. The data given me or actual conversation will be transcribed [Yip, Yip] and you will be given a copy of the transcription to go through and see if you think its valid and it is reflective of what you want to say [Yhmm], okay [Yip].

So to begin, will the first question is, what do you think when you were asked to participate in the journal club?

Umm I was interested in it, I thought it had very valid points and ideas, so the like I was a bit disorientates as I thought it might be a bit too much work but once I got into it I found it wasn't actually as much work and it was actually a lot more helpful that I originally thought it would be.

Okay, what was your experience of journal club at the outset and has it changed from undertaking it?

Yeah, definitely has, yeah as I said there I was disorientated at the start. I was oh no, but then yes, definitely it has. It has helped a lot with the studying and with everything, yeah.

Okay, your feelings towards it, has it changed dramatically? [2.08]

Yes, they have yeah, yeah as I said it was scary to start with thinking you would have to go into so much detail or you would have to actually read them. Some of them are very detailed and complicated to read so the thought of having to go and find them and read them, it was scary at the start but now, ymmm a lot better.

How is it a lot better?

Um, there it's more understandable. It was broken down a lot better. We were given a sheet with pointers on how to decipher the paper is a way and those points would help with our study and interpreting it so it helped in that way.

Have you increased your time reading peer reviewed literature since journal club?

Yes, I definitely have, yeah. It has definitely increased my time, yeah, it has been more and more

Yeah, has the journal club now improved the way you use peer reviewed literature for studying?
Yeah and if so how?

How I interpret them, it helps that way. It was difficult to interpret them before and now it is has helped, pretty much and just how I think on it, or how I would open it and read it has changed. My interpretation of them and their usefulness in [okay] research and college work.

Did you find the journal club benefitted you in critiquing scientific literature?

Yes, it did especially the sheet we were given out in and in how to decipher them and separate it all out.

How did you find the discussion after the presented paper?

Yeah, the group discussion was good after it when everybody involved got involved in it. Maybe if people got a wee bit more involved in it, it would have went a bit better, but yeah it was it...the way it was talked about, broke it down and made it a lot easier when students would say it in their language rather than maybe a lecturer speaking who has a lot more knowledge than we do. It was good [okay] yeah.

Would you recommend journal clubs as a tool for learning science?

Yeah I would yeah, yeah. I think it's easier almost to hear things from your students, it is easier yeah [okay] I think so.

What advice would you offer to new participants in a journal club?

Start early [laughter, laughter] I think so yeah, start early. There is a lot to read and they [yeah] are difficult but once you sit down and you put the tools you got to them, they are very beneficial, yeah. [Okay].

Have you any suggestions for improvement for the journal club?

Amm, maybe just, maybe starting earlier if the thing could be given just to extend the period of it. Would be good even starting a year earlier, although we are not graduates then but, it still

would give us an idea of how to use it, how to get into it, because it is a very valid thing that you need to do so I think starting maybe earlier maybe would be a good thing.

And is there anything you wish to add to this conversation?

No, I think it has been beneficial though maybe over a longer period of time it would maybe be more beneficial but then everybody would get more involved in it. It was a short period of time for, with you know, confirmation that you could go ahead [umm] then us actually been able to achieve that within the short period of time frame [umm] but if that was maybe extended I think everybody would get more benefit out of it because everybody would be able to read round it more and they would be reading around more than just maybe one or six or how or whatever groups that were doing it, so it would probably be more beneficial that was that way the longer time. [Thank you]

Thank you very much for your time

You are very much welcome.

It is 10.40 on the 17th of the 12th 2005 and I have concluded the interview with interviewee number 1

Interviewee #2

Hello, today is the 17th of December 2005, the time is 13.35 and with me is interviewee#2 okay, Thank you very much for participating in the interview. I just want you to be aware that this is an interview process to help with research we are looking at student engagement with journal clubs as a teaching tool for science for the Masters in learning and teaching here at Letterkenny Institute of Technology. At any time you wish to stop the interview, please say stop and the interview will be terminated. Everything about the interview will be anonymised and kept safely. Ahm, it is [umm] audio recover, recording of our conversation and I will transcribe the audio recording, I will give you a copy and you can see whether that is reflective of what the discussion we had was. All recording will be anonymised they will be stored in a [umm] an encrypted [umm] computer and also in a locked cabinet when they are transcribed. We are just about to begin, it should take you about [umm] five minutes or 10 minutes of your time is that okay?

Yeah, that is grand ...

Okay and I have your permission to record or

Yes

That's brilliant.

Yes you do indeed

That's okay brilliant.

So our first question, what did you think when you were asked to participate in a journal club?

When I was first asked to participate in it I [um] I was curious at first as to what exactly a journal club is, what you would do in it, how would it benefit all of us and each individually, amm, but I was very interested in getting or seeing what it was about.

What was your understanding of the journal club at the outset and has it changed since you took the experience aboard?

Umm, understanding at the outset was reading journals and not much more of it, since then, yeah it has changed it has um, showed me how you could look at papers and sometimes you would read them from a student's perspective, you would read them and glance over them and certain things just didn't really stick out to you or as well as what maybe they should have and it helped having someone there who was up to date and has a lot of knowledge of the literature to kind of guide you through reading the papers and give you pointers and more or less to say what it was all about.

Ah, okay, has your feelings towards journal club changed over the past few weeks and if so how?

Ah um, by feelings, oh I suppose I thought it was interesting to start off with, I enjoyed it, ah unfortunately, I didn't get to do my own presentation but I did the work for it and read up about it [laughter] ahm but no yeah it was interesting [um] yes I thought it was a good idea.

Um, okay, have you increased your time spending reading or spent reading peer reviewed literature since journal club?

Um ah, Yeah [laughter] I have [laughs]

Dramatically or, cause you are laughing here.

Ah, laughing 'cause there is a lot of I had to read a lot of papers in the last while a lot a lot a lot of papers in various different things and it did help having the mindset to look at them differently as opposed to just reading them as I did before

Okay, this leads into question five, how has journal club influenced how you now use peer reviewed literature for studying and if so, how?

Ah, yes more in the way that it made things feel a bit simpler that its not crazy and very hard to understand as long as you break things up into little points and just see what they are doing and move along in line like that, yeah, now, definitely it has helped me looking at them so far.

Okay, did you find the journal club helped you in critiquing scientific literature?

Ah, yeah, it benefited me I'm sure. I'm sure I'm not very good still [laughter] but it definitely benefitted [laughter]

Okay, am, can you just elaborate a bit, how did it benefit you?

Oh, Ah understanding [understanding] definitely the biggest word I can think of there is understanding, understanding what they are writing about and how they are written, how people write scientific journals cause we are not usually exposed to that, anything up until this year.

Um Okay, how did you find the discussion group or the group discussion after the present presented papers?

Ah it was always good fun [um] it was relaxed, we all sat back had a chat it was, was good yeah. It was very nice sitting back with everyone talking about stuff that you normally wouldn't really have a conversation about but it was still interesting obviously because we are all doing science, we are interested in it so [um] so the discussions afterwards, yeah usually about the different papers was good yeah.

Okay, would you recommend journal clubs as a tool for learning science?

Definitely, without a doubt, I, I thought it was very good. I thought it was very good. I thought it was good to sit down and make and read each of the like eight different journals and go through them all and with them all being on different topics [um] it gave you a bit of understanding for each topic a bit better, yeah.

What advice would you offer to new participants in a journal club?

Um, I'm not too sure for that one really advice ah, yes read the papers. Don't not read the papers and turn up [laughter]. Yeah definitely read them 'cause, they're interesting to read yeah.

Okay, am have you any suggestions for improvement for the journal club?

Am, more time of it, definitely, more time of it. I would have liked to have started it earlier on in the year and done it throughout the year. The whole way up to now. And I think it would have helped, yeah definitely with knowledge in everything really, yeah.

Okay, fantastic, have you any suggestions (we have done that one) Is there anything you wish to add to this conversation?

Ahm, not particularly just to say thank you very much for doing it and everything.

Okay, much appreciated amm interview terminated at 13.41 on 17th December 2015 with interviewee number 2. Thank you

Interviewee #3

Okay, thank you very much for coming. I am just going to talk to you, oh, the time is 13.58 on December 17th 2015 and I am with Interviewee #3 in the science department. Ahhm, I am conducting interviews to see how the journal club ah, experience was for you as a teaching tool for science. Umm, it is part of my research for the Masters in Learning and Teaching here in Letterkenny Institute of Technology. Please be assured, ah, if you want to stop in the interview at any stage just say stop and we will terminate the interview. All data from the interview will be audio recorded, are you okay with that? [Yeah]. And it will be stored in a secure environment. It will be anonymised on the computer and it will also be stored in a locked ah, filling cabinet. Ahm when the interview is transcribed, I will give you a copy to see if you are in agreement with the conversation we had is reflective of the conversation. So ahm, there is just a few questions that I sent you before that I would like to actually ask ah, for ah solidifying this research.

What did you think when you were asked to participate in a journal club?

I suppose I didn't know what a journal club actually was to begin with but I found out from my peers then that it would be helpful to do the journal club with my studies.

Um, okay, what was your experience of the journal club at the outset and has it changed from undertaking this experience?

I quite enjoyed the journal club now, I was a bit sceptical at the start about starting it because I didn't know what it really was and I didn't know what I was putting myself in for or how much work it would actually be, me doing my exams, but I think I learnt a lot about umm the actual content itself, amm. It ties in all the techniques that we learnt in previous year. Suppose it will be helpful towards exam time in revising.

Has your understanding changed from the experience?

I suppose it has as I was a bit sceptical at the start. I really didn't understand how it would benefit me to begin with but it has benefited me in some parts

Ah, okay, has your feelings towards journal club changed over the past few weeks and if so how?

I don't think so nah.

Okay, initially where you apprehensive are you more relaxed with the concept?

I definitely am more relaxed about it now. I wasn't sure that I was getting into [um] and amm as the weeks went on and when I was sitting in listening to other people revising, I was just thinking okay, right, I didn't think of that theory. I didn't think of that topic so we kind of bounced of each other as a group.

Has, have you increased your time reading peer reviewed literature since the journal club?

I definitely have. I am able to read the literature and know what's good and what's bad literature and what's relevant and what's not I think from using the journal club.

Has the journal club influenced how the way you now use peer reviewed literature for studying and if so, how?

I suppose it ties in all the key points that you really want in an essay question. Sometimes it was very hard for me to get those points and sculpt them all together in an essay. And now reading more journals I am kind of understanding more what to actually add in.

Um, did you find the journal club, you kind of insinuated this in the last question, did you find the journal club benefitted you in critiquing scientific literature?

I definitely have, yeah,

[mumbling] How did you find the group discussion after presented papers?

I found them quite interesting, Am, some points came up that I didn't even think about when I was reading the peer papers [um] nice things to comment on

Would you recommend journal clubs as a tool for learning science?

I suppose I would, it would be nice to have more time doing the journal club itself because you are more relaxed about it and taken it all in and it's taken all in your stride, more so than learning them all off, but it would be definitely something you would enjoy doing just as a group.

What advice would you offer to new participants in a journal club? So somebody who has never done a journal club, what advice would you give them now having gone through it?

I suppose look at a lot of journals and look at the dates and make sure, read through them and critique the actual journal itself not all journals are the best that is out there so amm critique them and get one that is really relevant and update and current with the info instead of one that is really old.

Anything else?

I don't think so

Have you any suggestions for improvement of the journal club?

I suppose more time. If you do it over, a longer period of time. It's not as hectic it's not as, you are learning things off, reading different papers and it's a lot stressful, amm, towards exams time. It would be nice to just do it in a more relaxed ah sort of basis.

Okay, is there anything you wish to add to this conversation?

I don't think so,

Okay,

Thanks very much for your time. The interview finished at 14.04 on the 17th of December 2005 with interviewee#3.

Appendix 8

Interview Prep Worksheet

		Tick	Comment
1	Thanking interviewee		
2	Explaining purpose of research (again), confidentiality and anonymity		
3	Explaining that the interview can be stopped at any time if the interviewee wishes		
4	What will happen the data		
5	Request to record the interview electronically		
6	Amount of time		

Interview

		Tick	Comment
1	Location of interview		
2	Date and time		
3	Setting		
4	Background of participant		
5	Immediate impression following interview on how it went		

Journal Club Interview Questionnaire

1. What did you think when you were asked to participate in a journal club?
OR
1. What is your understanding of journal club? **RO1**
2. Has your understanding and/or feeling towards journal club changed over the past few weeks? If so, how? **RO1**
3. Have you increased your time spent reading peer reviewed literature since journal club?
RO1 RO2 RO3
4. Has the journal club, influenced the way you now use peer reviewed literature for studying? If so, how? **RO2 RO3**
5. Did you find the journal club helped you to be more able to critique scientific literature?
RO2 RO3
6. How did you find the group discussion after presented papers? **RO3**
7. Would you recommend journal clubs as a teaching tool for science? **RO3**
8. What advice would you offer to new participants in a journal club?
9. Is there anything you wish to add to this conversation?

Research Outcomes		Applicable questions on Interview Questionnaire			
RO1	To ascertain if undergraduate science students are engaging with science literature.	1	2	3	
RO2	To appraise if participation in an undergraduate journal club increases students' perception of engagement with science literature.	3	4	5	
RO3	To evaluate if participants of an undergraduate journal club perceive enhancement of their learning experience in undergraduate science.	4	5	6	7

Appendix 9

Article Review Form

Use this form to help guide your Journal Club discussion. Prepare ahead by reading the article to be discussed and thinking about the questions below. Jot down notes, discussion points, and your own questions to stay on track!

Question

Notes

1. What is the purpose of this article?
2. What was the scientific question the investigators were asking?
3. Can the methodology answer that question?
4. If the methodology is adequate, what is the answer to the research question, and how reliable is that answer?
5. How can you apply this article in your practice?
6. Do the findings from the article support the current policies and procedures in your practice?
7. What could the author(s) have done differently to further strengthen this article?
8. Do you spot any flaws with the research behind this article?
9. Do you see any conflicts of interest that would cause you to question the validity of this article?
10. In your opinion, should this article have been published?

Appendix 10

Data to support Questions 1-6 on pre- and post-journal club questionnaires

		pre-journal club (%)	post - journal club (%)
Q1	Male	21	22
	Female	79	78
Q2		pre-journal club (%)	post - journal club (%)
	Pass	29	22
	Merit 2	29	33
	Merit 1	29	22
	Distinction	14	22
	N/A	0	0
Q3	Access	pre-journal club (%)	post - journal club (%)
	Yes	100	100
	No	0	0
Q4a	Hardcopy	pre-journal club (%)	post - journal club (%)
	Yes	0	0
	No	100	100
	e copy		
	Yes	29	56
	No	71	33
	LYIT library		
	Yes	93	78
	No	7	11
Q6	Experience	pre-journal club (%)	post - journal club (%)
	Yes	100	89
	No	0	11

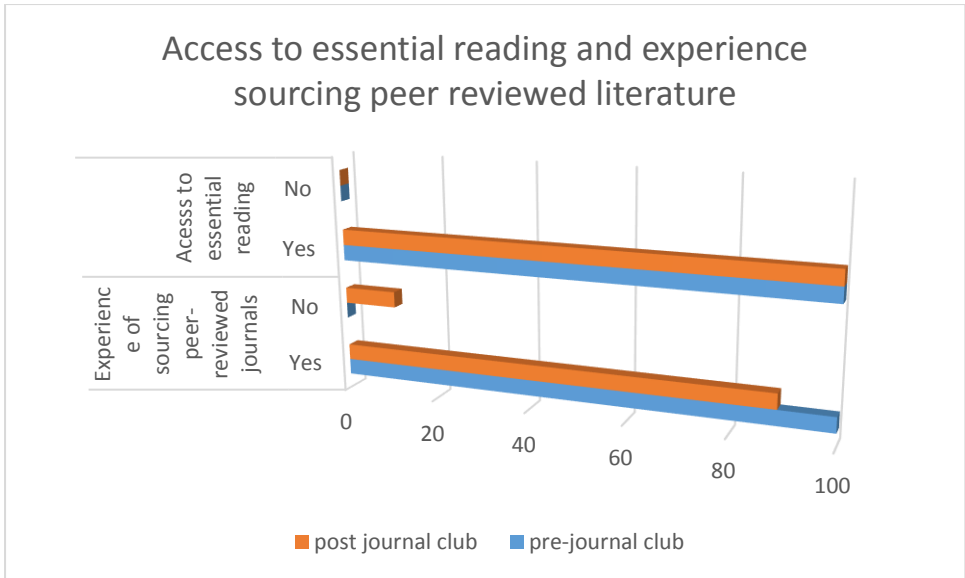


Figure 9A.1 Access to essential reading and sourcing of peer reviewed literature pre- and post- journal club (Question 3 and 6)

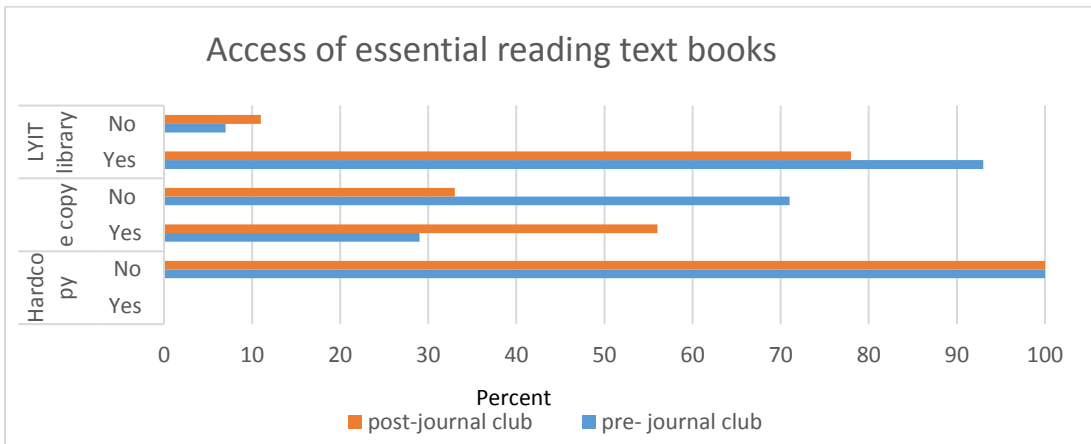


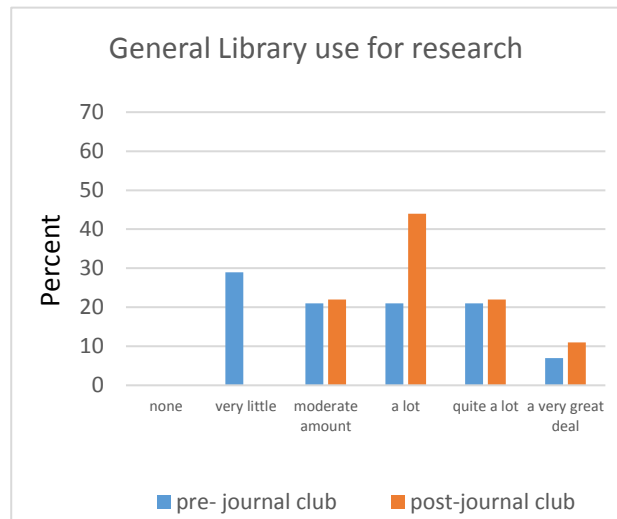
Figure 9A.2 Students chosen route of access to essential reading text books pre- and post-journal club (Question 4)

Appendix 11

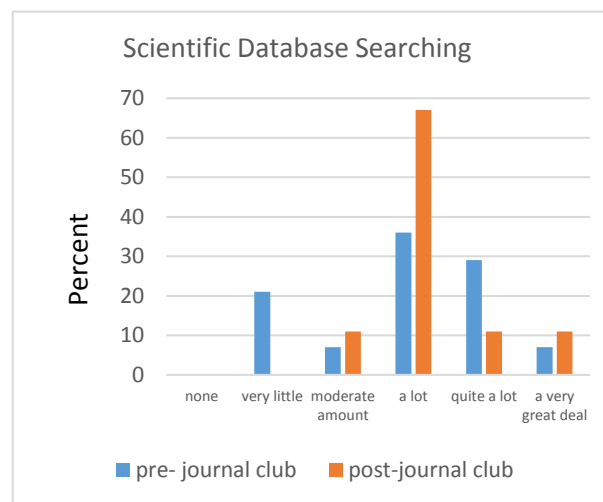
Question 9

Data from pre- and post- journal club questionnaires for Question 9..

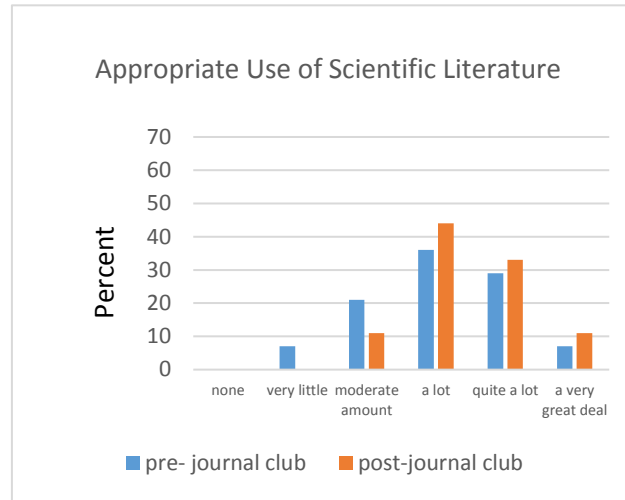
Q9a	pre- journal club	post-journal club
	%	%
none	0	0
very little	29	0
moderate amount	21	22
a lot	21	44
quite a lot	21	22
a very great deal	7	11



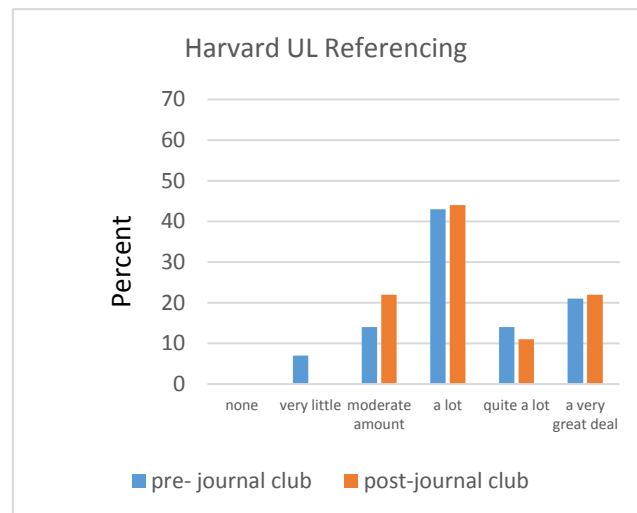
Q9b	pre- journal club	post-journal club
	%	%
none	0	0
very little	21	0
moderate amount	7	11
a lot	36	67
quite a lot	29	11
a very great deal	7	11



Q9c	pre- journal club	post-journal club
	%	%
none	0	0
very little	7	0
moderate amount	21	11
a lot	36	44
quite a lot	29	33
a very great deal	7	11



Q9d	pre- journal club	post-journal club
	%	%
none	0	0
very little	7	0
moderate amount	14	22
a lot	43	44
quite a lot	14	11
a very great deal	21	22



Appendix 12

Data from pre- and post- journal club questionnaires for Question 10.

Q10a	pre- journal club	post-journal club
	%	%
none	7	0
very little	14	11
moderate amount	36	11
a lot	21	44
quite a lot	14	22
a very great deal	7	11

Q10a	pre- journal club	post-journal club
	%	%
none	7	0
very little	36	22
moderate amount	29	44
a lot	7	11
quite a lot	21	11
a very great deal	0	11

Q10c	pre- journal club	post-journal club
	%	%
none	0	0
very little	7	0
moderate amount	29	33
a lot	29	0
quite a lot	21	33
a very great deal	14	33

Q10d	pre- journal club	post-journal club
	%	%
none	29	0
very little	7	0
moderate amount	14	11
a lot	21	0
quite a lot	14	33
a very great deal	14	56

Data from pre- and post- journal club questionnaires for Question 11.

Q11a	pre- journal club	post-journal club
	%	%
<1 hr	7	11
<2-3 hrs	57	44
<4-5hrs	21	11
<5-6hrs	0	22
<6-8hrs	7	11
>8hrs	7	0

Q11b	pre- journal club	post-journal club
	%	%
<1 hr	36	44
<2-3 hrs	57	33
<4-5hrs	7	11
<5-6hrs	0	11
<6-8hrs	0	0
>8hrs	0	0

Q11c	pre- journal club	post-journal club
	%	%
<1 hr	7	0
<2-3 hrs	21	0
<4-5hrs	21	44
<5-6hrs	0	11
<6-8hrs	43	33
>8hrs	7	11

Q11d	pre- journal club	post-journal club
	%	%
<1 hr	21	11
<2-3 hrs	21	11
<4-5hrs	7	11
<5-6hrs	14	11
<6-8hrs	29	33
>8hrs	7	22

Data from pre- and post- journal club questionnaires for Question 12.

Q12a	pre- journal club	post-journal club
	%	%
none	0	0
very little	14	0
moderate amount	43	22
a lot	14	22
quite a lot	14	33
a very great deal	14	22

Q12b	pre- journal club	post-journal club
	%	%
none	0	0
very little	29	0
moderate amount	29	22
a lot	21	33
quite a lot	21	33
a very great deal	0	11

Q12c	pre- journal club	post-journal club
	%	%
none	14	11
very little	50	0
moderate amount	7	11
a lot	14	11
quite a lot	0	44
a very great deal	14	22

Q12d	pre- journal club	post-journal club
	%	%
none	29	11
very little	29	11
moderate amount	21	22
a lot	21	22
quite a lot	0	22
a very great deal	0	11