Factors which aid or inhibit peer-to-peer interaction and collaboration during Project Based Learning in a virtual high school for anxious school refusers: A case study in the United Kingdom

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Abstract

The prevalence of adolescent school absenteeism due to severe bullying in the UK exceeds 16 000 young people, and the occurrence of anxious school refusers (including self-exclusion due to bullying) is a well-documented issue that transcends geographical borders. The research context for this study is a virtual school (Red Balloon of the Air) that provides educational, therapeutic and social support for some of these young people who are missing out on an education, many of whom have had difficult experiences with peers in previous educational settings. The aim of this case study was to investigate factors that aid or inhibit peer-to-peer interaction and collaboration during a Project Based Learning (PBL) activity in a virtual high school for anxious school refusers. A conceptual framework drawing on the works of Moore (1989), Curtis and Lawson (2001) and Murphy (2004) was developed to analyse the subsidiary research questions. The findings show that notable levels of peer-to-peer interaction were recorded in the chat transcripts from the PBL activity (31.9%), however this interaction did not constitute any notable form of collaboration in the small group activities where the highest concentration of peer-to-peer interactions were recorded. The factors that appear to aid peer-to-peer interaction include incorporating small group work, pairing newer students with more experienced students, and introducing blended learning opportunities whereby students interact face-to-face. In addition to this, on average an increased length of time at the virtual school seems to increase peer-to-peer interaction, with the exception of students experiencing emotional difficulty during activities, and level of student choice resulting in students sometimes choosing to working alone. The role of the teacher in peer-to-peer interactions and supporting collaboration is a prominent theme, in particular how the use of technology increases the teacher's access to student conversations which could make the teachers more likely to intervene with solutions. Peer-to-peer interaction and social presence are a pre-requisite for collaboration, however as evidenced in this study the presence of both does not automatically mean collaboration will occur. The limitations of this study include that the findings are based on one PBL activity, which took place in the final weeks of the academic year with no links to the national curriculum. The findings of the study serve as a foundation for further research in the field.

Key words:

Anxious school refusers, Project Based Learning, virtual schools, peer-to-peer interaction, collaboration, social presence

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Abbreviation and Acronyms

BIE	Buck Institute for Education
CLC	Collaborative Learning Conversation
FLVS	Florida Virtual School
iNacol	International Association for K12 Online Learning
NATCEN	National Centre for Social Research
PBL	Project Based Learning
RBAir	Red Balloon of the Air
RBLCG	Red Balloon Learner Centre Group

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1 Introduction

1.1 Overview

A National Centre for Social Research (NATCEN) report estimates the prevalence of young people (aged between 11 – 15) absent from school due to severe bullying in the United Kingdom (UK) to be 16,493 (Brown, Clery & Ferguson, 2011). The occurrence of adolescent 'anxious school refusers', which includes students who self-exclude due to bullying, has been well documented and researched (Egger, Costello & Angold, 2003; King & Bernstein, 2001; Sloan Alday, 2009) and is a global issue that transcends geographical borders and cultures (Granell de Aldaz, Feldman, Vivas & Gelfand, 1987; Honjo et al., 2001).

Over the past nineteen years, Red Balloon Learner Centre Group (RBLCG[1]), an educational charity in the UK, has developed an individualised programme for students aged between thirteen to sixteen who are 'anxious school refusers' not attending mainstream schools primarily due to severe bullying. By providing a holistic education, the organisation's main aims are to raise students' self-esteem and confidence, to get them back on an academic track, and to support their return to formal schooling, further education or employment.

RBLCG has established four physical learner centres across the UK and a virtual centre called Red Balloon of the Air (RBAir[2]). RBAir provides opportunities for students without access to one of the four learning or who feel unable to leave home due to high levels of anxiety. At the time students join the programme they have not been attending mainstream school from anywhere between three months to one and half years. Most are engaging in little or no formal education at home, although most students display some propensity to want to learn. Addressing all of the needs of the young person is integral to the success of the programme and the focus is on academic, social and emotional development. Based on the philosophy and practice of the physical centres, the five key components of RBAir's holistic programme include offering (1) well-being (which includes online counselling and small therapeutic groups); (2) individualised learning plans (offered through a negotiated curriculum); (3) parent support programme (an important intervention for student support and transition); (4) blended support (online learning is supplemented by face-to-face support with a regional mentor

[1] http://www.redballoonlearner.org/

[2] http://www.redballoonlearner.org/Life-at-RBAir-centre

wherever geographically possible); and finally (5) a safe and supportive community (where students benefit from the power of shared experience in a small community and are met with unconditional positive regard). Building social confidence and skills, trust in others and developing friendships is a key part of the community programme.

A challenge faced at RBAir is to provide students with the opportunity for peer-to-peer interaction and to encourage them to build the confidence to interact with others. Commonly students have low self-esteem and confidence and experience high levels of social isolation. They may often be fearful of interactions with peers their own age due to the traumatic experiences they have encountered. Positive peer-to-peer interaction is a minimum aspiration the organisation has for these young people, as building the confidence and developing the social skills to interact with others will be an essential stepping-stone to reintegrate into further education. Ultimately however, a key objective is for students to collaborate, which Lee defines as 'a student-centred approach in which groups of individuals work jointly on a well-defined learning task' (2009, p.150). There are multiple reasons for the need to include collaborative group work in the programme and the cognitive and psycho-social benefits are explored in greater detail in the literature review.

Karoly holds that although collaboration is not a new interpersonal skill needed in the workplace, however the 'degree of importance for collaborative capacity is growing in an era where work in knowledge-based economies is increasingly accomplished by teams of people with complementary expertise and roles, as opposed to individuals doing isolated work in an industrial setting' (2004, as cited in Dede, 2010, p.52). The nature by which this collaboration is achieved is increasingly in online contexts where people rarely meet face-to-face (Dede, 2010). The learning context that this dissertation explores offers an ideal opportunity for students to develop online collaboration skills that could perhaps provide cognitive and psycho-social benefits as well as prepare them for working life in the 21st century.

A collaborative Project Based Learning opportunity at RBAir is the unit of analysis in the study. Project Based Learning is an instructional strategy that has been well documented as a way to promote peer-to-peer interaction and collaboration for students in a multitude of different contexts (Chang, 2014; Finger et al., 2006; Papanikolaou & Boubouka, 2010). Following an extensive literature review, no research specifically focusing on peer-to-peer interaction, collaboration and the use of PBL in a virtual school for anxious school refusers was located. This research study focuses on a seemingly niche context, but due to the prevalence of adolescent mental health issues in Great Britain (Green, McGinnity, Meltzer, Ford & Goodman, 2004) as well as reports of global occurrences of anxious school

refusal (Granell de Aldaz et al., 1987; Honjo et al., 2001) this exploratory research could be shared with other interested parties seeking to provide support for anxious school refusers. Although this case study focuses on a small number of students and consequently has several limitations it will hopefully serve as a foundation for additional research in the field.

It is worth acknowledging that I worked for RBLCG until October 2015, and was part of the development of RBAir. I recognise my connection to the research context highlights an abundance of validity and ethical concerns, and these are addressed in Chapter 3. In addition to this it is worth recognising that my passion lies in understanding and improving educational contexts so I approach this exploratory research as a means to enhance understanding and improve outcomes for students, staff, and anyone else wishing to undertake similar work to support anxious school refusers.

In this study, many of the key concepts are complex and have multiple definitions, however for clarity a brief explanation is provided here and Chapter two provides a more extensive explanation of the key concepts. Collaboration is defined as 'a student-centred approach in which groups of individuals work jointly on a well-defined learning task' (Lee, 2009, p.150), whilst peer-to-peer interaction refers to the interaction between two students. For this research, I will refer to a 'virtual high school' as any full-time education provision offered to students generally aged between 12 - 17 years who are enrolled at the school and are receiving an education predominantly via the Internet. Finally, project-based learning is a widely debated instructional strategy, however for this research I have used the Buck Institute for Education's[3] (BIE) outline which includes key components of problem-solving, enquiry, rigorous authentic projects and the full definition is provided in Chapter two.

1.2 Research questions

The main research question that serves to frame the study is:
What factors aid or inhibit peer-to-peer interaction and collaboration during project-based learning (PBL) in a virtual school for anxious school refusers?

The subsidiary questions are:

1) What type of interaction occurs during the PBL activity for anxious school refusers?
2) What is the nature of peer-to-peer interactions taking place in the PBL activity?
3) What evidence of collaboration exists during the PBL activity?

[3] http://bie.org/

1.3 Overview of research design

A case study approach (Easton 2010) outlined from a critical realist perspective was employed in this study. A mixed method approach including both qualitative and quantitative analysis was utilised to analyse the data collected (Creswell, 2015). A conceptual framework adapted from the work of Moore (1989) was developed to analyse and identify Interaction Types in subsidiary Research Question 1.
A conceptual framework was developed using Curtis and Lawson (2001) and Murphy's (2004) collaboration frameworks and this was used to analyse the nature of student interactions and evidence of collaboration for subsidiary Research Questions 2 and 3 respectively.

1.4 Thesis structure

Chapter 1 provides an overview of this research study by briefly summarising the context, rationale, research questions, conceptual framework and research design.

Chapter 2 reviews the relevant literature on the key concepts including 'anxious school refusers', 'virtual high schools' and 'Project Based Learning'. This chapter also examines conceptual frameworks for understanding interaction and collaboration and explains the use of Moore (1989), Curtis and Lawson, (2001) and Murphy (2004) as suitable frameworks for analysing the data collected.

Chapter 3 introduces the research design and methodology used in this study. It includes the selection of participants and sites, data collection methods, and justifying the frameworks developed to analyse data collected in relation to each research question. This chapter also includes the ethical and validity concerns considered throughout this study.

Chapter 4 presents the findings of this research study, and provides a detailed discussion of the data analysed in relation to the literature review for each research question. A summary of the factors that aid and inhibit peer-to-peer interaction and collaboration in this research context is provided.

Chapter 5 provides a summary of the research findings, and finally highlights opportunities for further research and recommendations for the organisation to consider.

2 Literature review

The literature review section focuses on presenting the key concepts that are relevant to the research questions. The primary research focus for this study aims to identify the factors that aid or inhibit peer-to-peer interaction and collaboration during a PBL activity in a virtual school for anxious school refusers. Firstly, the concepts of 'anxious school refusers' and 'virtual high schools' are defined and relevant literature presented respectively. Following this, 'interaction and collaboration' are discussed and frameworks for analysing peer-to-peer interaction and collaboration are presented. In subsidiary research question one, 'Interaction Type' is a key concept and relates to different types of interaction presented in an interaction analysis. Moore's interaction analysis (1989) is presented, however justification for a modified version of his model is argued. Research questions two and three address, respectively, the nature of peer-to-peer interactions, and whether or not this interaction constitutes collaboration. The key concepts relate to collaboration analysis, and although multiple frameworks for analysing collaboration are explored, the use of Curtis and Lawson's (2001) is justified as the appropriate choice for this research. Project Based Learning is then examined as a method for facilitating collaboration and peer interaction, and then relevant research on PBL in online contexts in virtual high schools is presented.

2.1 Anxious school refusers

RBLCG was initially set up to support a cohort of young people who are no longer attending school due to severe bullying. Although this remains a primary aim, the range of young people who benefit from support has been extended to include 'self-excluded' young people or 'anxious school refusers'. King and Bernstein conducted a review of ten years of 'school refusal' literature and highlight that the issue of school refusal is 'complex with variable presentations' (2001, p.199) which include a multitude of personal and environmental factors resulting in non-attendance at school. They define school refusal as 'difficulty attending school, associated with emotional distress, especially anxiety and depression' (King & Bernstein, 2001, p.197). Much of the academic debate on 'school refusal' is complicated by what should be included under the term and whether or not anti-social behaviour and truancy are included under the umbrella term 'school refusal' (Lee & Miltenberg, 1996 in King & Bernstein, 2001). Essentially the underlying causes of 'school refusal' are extensive, the individual contexts complex, and the exact reasons for non-attendance at school are not always immediately clear.

Egger et al. (2003) provide a more refined approach to understanding 'school refusal' by identifying three different types, including 'pure anxious school refusers', 'pure truant', and 'mixed school refusers'. Their findings showed that 'pure anxious school refusers' appeared to have the most difficulty in peer relationships and they 'experienced being bullied or teased, and had difficulty in their peer relationships both because of withdrawal and increased conflict more often than non-school refusers' (2003, p. 800). From this definition, it is primarily the 'anxious school refuser' whom RBAir seeks to support.

Sloan Alday also makes reference to the link between bullying and school refusal highlighting that, 'school refusal may be related to separation anxiety, academic worries, fear of a strict teacher or bully, or worries about getting along with peers socially' (2009, p.6). Furthermore, Egger et al. consider that a school refuser's 'resistance to going to school or leaving home may not be excessive or unreasonable (i.e. phobic), but rather an "appropriate" response to real events' (2003, p.805). Studies by Berg and Maughan, have supported the idea that 'school environment' and peer effects contribute to behaviour problems and school absences (in Egger et al., 2003, p.805). The issues of non-attendance do not always appear to lie with the student and their family, but sometimes reflect a justifiable response to a detrimental school environment.

Whether the cause of school absence for a student at RBAir is due to issues with relationships with peers, anxiety or negative aspects of the environment itself, this cohort of students has difficulty accessing an education because they feel unable to attend school. The negative consequences of non-attendance at school are well documented and include legal complications, poor academic performance, family difficulties and peer relationship problems (Last & Strauss, 1990; Naylor et al., 1994 in King & Bernstein, 2001).

Many of the young people referred to Red Balloon display high levels of anxiety at the prospect of interacting with peers their own age. Most of the participants in this study have experienced some level of bullying at school and all have had poor, or no, attendance at school (in some cases zero attendance at school for more than 6 months). Their educational needs are as important as their psychological and social needs.

Some research has been conducted on how to treat anxious school refusers (Heyne et al., 2002) but given that 'anxious school refusal' is a complex issue with several possible underlying causes, it is unlikely there will be a blanket solution to the problem. RBAir uses a range of tools and approaches to help meet the various needs of these young people to support them to re-enter education or

employment. The typical characteristics of the student, their associated needs, and the tools available to address their needs are summarised in Table 2.1 below. Although there is significant overlap between the academic, social and emotional needs of this cohort of students, they are presented separately for the purpose of clarity.

***Table 2.1** Summary of student profiles, needs and organisational tools in RBAir*

	Typical Characteristics	*Needs*	*Tools to Address Needs*
Academic	• Gaps in education from non-attendance • Low levels of confidence • Difficulty engaging in large educational groups	• Student led activities to build confidence • One-to-one sessions to address learning gaps and small group work	• Student led negotiated curriculum, • Project Based Learning activities
Social	• Social isolation from peers • Possible challenges with social skills • Low confidence in groups	• Peer-to-peer interaction in safe, supportive environment • Opportunities to increase social skills and social awareness	• Collaborative learning experiences • Small group work, circle time, games • Limited blended learning opportunities to work face-to-face with a mentor and peers
Emotional	• Low levels of self-esteem and confidence • High levels of anxiety • Possible trauma experienced in previous educational settings	• Opportunities to develop emotional intelligence • Opportunities to process emotional experiences • Opportunities to build self-esteem and positive self-image	• Online counselling opportunities with qualified counsellor • Small therapeutic groups

RBAir provides a full time programme for these young people, which includes education, therapy and a supportive community predominantly accessed through a virtual school. With a better grasp of the needs and characteristics of this cohort of the young people, it is possible to explore the key concepts of peer-to-peer interaction, collaboration, virtual schools and Project Based Learning meeting the student needs identified in Table 2.1.

2.2 Virtual high schools

The context for this research study takes place in a 'virtual high school'. Although RBLCG refers to it as a 'virtual centre', for the purpose of this academic research the more universally identified term of 'virtual school' used by Barbour and Reeves (2009) will be utilised, and furthermore the term 'virtual high school' refers specifically to a virtual school in a secondary education context.

The terms 'virtual high school', 'online high schools', 'cyber-schools' or 'distance education' are terms that are often used interchangeably to describe the same phenomena. In a review of the literature on virtual schools in the USA, Barbour and Reeves propose a definition of a virtual school as 'an entity approved by a state or governing body that offers courses through distance delivery – most commonly using the Internet' (2009, p.1). This provides some clarity, however it is not always the case globally that a proposed 'virtual school' is approved by a state or governing body.

Barbour and Reeves' (2009) definition requires further consideration of a number of additional variables when defining a virtual school, including whether provision is full-time or part time, the level of interactivity between students and teachers, asynchronous versus synchronous delivery, and whether or not the online education is supplemented with any face-to-face interaction in a bricks and mortar facility. As each of these variables might greatly alter the experience of a student attending a 'virtual high school', it is challenging to propose a definition that addresses all these variables simultaneously. For the purpose of this research I will refer to a 'virtual high school' as any full-time education provision offered to students generally aged between 12 - 17 years who are enrolled at the school and are receiving an education predominantly via the Internet. Although the interactions between teachers and students may be asynchronous or synchronous, in this research context the majority of interaction occurs synchronously. The inclusion of 'via the internet' is often associated with 'online learning' which the International Association for K12 Online Learning (iNacol) have defined as 'education in which instruction and content are delivered primarily via the internet' (Barbour et al., 2011, p.5) Many of the factors that inhibit peer-to-peer interaction in 'online learning' may overlap with factors in a virtual school. Given that 'online learning' is the primary mode of delivery in a virtual school, some of the factors from the literature associated with 'online Project Based Learning', and 'online collaboration' are highlighted in the sections that follow.

In the iNacol survey of K12 online and blended learning around the world, it was noted that online learning is most often accessed by students with 'extenuating circumstances' that prevent them from attending mainstream school. These circumstances most commonly include 'student athletes, students with chronic illness and disease, and those who were hospitalized, homebound, incarcerated,

and severely disabled' (Barbour et al., 2011, p.14). Although 'anxious school refusers' are not specially mentioned, they could be included in 'homebound' or students with 'illness' which would include anxiety and depression.

The advantages of virtual schooling for an anxious school refuser includes the fact that they can continue to access an education without the barrier of entering a physical bricks and mortar school, as well as interacting with peers in a less threatening environment. The online forum has also been noted as a 'more equitable form of group participation especially for quieter students' (Ellis, 2001, p. 171).

One of the distinct disadvantages of online learning, which is a vital aspect of a virtual school, is an increased sense of isolation, lack of interaction with peers face-to-face, and possibly less incentive for 'anxious school refusers' to leave home. A growing trend in online courses, or virtual schools is to provide 'blended learning' to overcome some of the adverse outcomes of online learning. Blended learning, is another ill-defined term whose usage has proliferated over the past few years, and a full discussion is beyond the scope of this research. At a simplistic level, 'blended' or 'hybrid' learning is defined as a combination of online and face-to-face learning.

The particular benefits and challenges of blended learning have been widely researched (Staker et al., 2011), indicating that the outcomes may be influenced by a number of variables including type of delivery, age of participants and reasons for attending blended provision.

2.3 Project-based learning

This research study focused on 'Project Based Learning' as a potential vehicle for facilitating peer-to-peer interaction and collaboration. PBL is not a new instructional strategy (Kilpatrick 1918, in Howard, 2002), however the concept has evolved, and the parameters have been debated over the years to determine what constitutes Project Based Learning.

Thomas (2000) produced a review of the literature on PBL that has been widely cited. Within this comprehensive review Thomas highlights the interchangeability of PBL with 'problem based learning' and 'enquiry based learning' and draws on some of this research in his review. He noted a growing distinction in the literature between simply 'doing a project' and undertaking rigorous Project Based Learning and summarises 'criteria' from the literature for determining whether or not a project can be considered 'Project Based Learning'. The five overarching criteria identified include: centrality, a driving question, constructive investigations, autonomy and realism (Thomas, 2000, p.3).

Fifteen years later, Condliffe (2015) undertook to update Thomas's (2000) PBL review and summarised the proliferation of research in the field. She concludes that although much work has been done there is still some disparity as to the essential 'design principles' that distinguish PBL from other instructional approaches. Condliffe identifies additional design principles to Thomas (2000) and some of these include, 'provide opportunities for student reflection and teacher feedback', 'encouraging student choice', 'supporting collaborative learning', and 'using scaffolding to guide student learning' (2015, p. 9-15). Although the criteria and design principles identified in Thomas (2000) and Condliffe (2015) do not serve as a definition of PBL, they help to determine key elements that need to be present to determine practice as PBL.

For the purpose of this research the understanding of the term 'project-based learning' will refer to that of the Buck Institutes for Education[4] (BIE) that aligns with the Florida Virtual School [5](FLVS) approach to PBL.

> 'PBL is … an extended process of inquiry in response to a complex question, problem, or challenge. While allowing for some degree of student "voice and choice," rigorous projects are carefully planned, managed, and assessed to help students learn key academic content, practice 21st Century Skills (such as collaboration, communication & critical thinking), and create high-quality, authentic products & presentations' (BIE definition, in White, 2012, p2).

This definition is helpful as it captures some of the 'design principles' identified by Thomas (2000) and Condliffe's (2015) research and also includes 'collaboration'. According to Condliffe, Grant and Krajcik and Shin see collaborative work as 'an essential element of PBL' (cited in Condliffe 2015, p.14). More specifically, Krajcik and Shin explained that the collaborative activities in their science PBL activities '[mirror] the complex social situation of expert problem solving' (cited in Condliffe 2015, p.15). Condliffe does however highlight that the design principles identified in the literature review do not make it clear what this collaboration should look like, and also stresses that additional research is required in the field.

[4] http://bie.org/
[5] https://www.flvs.net/

Despite some of the inconsistencies in PBL design principles, it is worth highlighting some of the documented advantages to this instructional approach. Whilst Project Based Learning is not the only instructional strategy highlighted for facilitating collaboration, it is of particular interest to RBLCG given the additional benefits it may have in meeting the social, emotional and academic needs of anxious school refusers. Neo and Neo (2009) identified PBL benefits to include increased student interest, critical thinking, presentation skills, communication and teamwork for students participating in PBL instruction. The social and emotional benefits recorded include increased self-esteem and confidence (Katz & Chard, 1992 in Tamim & Grant, 2013). In addition, PBL is reported to promote inquiry and the intrinsic value of learning (Hertzog, 2007, in Tamim & Grant, 2013). Akinoglu identified building creative thinking skills as the benefit most gained (2008 in Tamin & Grant 2013), whilst Ravitz and Blazevski stated the strongest reasons for using PBL were the teaching of skills beyond the content, personalized learning and teaching academic content more effectively (2014). Tamim and Grant identify four sets of advantages perceived by teachers utilising PBL that included 'support and facilitation of the learning process, differentiation and creative abilities, motivation and engagement, and collaboration' (2013, p.81-83).

The strength of these identified positive outcomes often has to do with the quality of the PBL instruction and ability to overcome the barriers to effective PBL. There have been a number of challenges experienced in PBL implementations. Archilles and Hoover highlight students' lack of social skills and ability to work in groups as a factor inhibiting effective PBL (1996, in Thomas 2000). Practical constraints of implementing PBL have also been documented, including 'fixed and inadequate resources, inflexible schedules, and incompatible technology' (Edelson et al. 1999, in Thomas, 2000, p.26). In addition to this a number of challenges relating to the teacher and as Condliffe notes, 'without a clear vision for what a PBL approach should look like, it is difficult for teachers to assess the quality of their implementation and know how to improve their approach' (2015, p.17). Thomas aptly sums up the tension in the teacher's role between teacher support and student independence in the following extract:

> 'Project-Based Learning is often implemented in such a way that students end up engaging in desultory, "unguided discovery." To counter this tendency, it is unsatisfactory to have a teacher intervene and direct students in their inquiry, while it is equally unsatisfactory to allow students to flounder or to put in large blocks of time exploring unproductive ideas in their investigations' (Thomas 2000, p. 33).

Further to this, and specifically relating to collaboration, Thomas highlights the key issue with collaboration in PBL is that although students may be used to working with others, they are not used to 'giving feedback, and articulating and synthesizing their own work with the work of fellow students' (Thomas, 2000, p.31).

A number of ways to improve the effectiveness of PBL and overcome some of the identified challenges have been proposed in the literature, but perhaps most notably Thomas proposes allowing teachers time and space to reflect on their practice as, 'most teachers will find aspects of PBL planning, management, or assessment fairly challenging and will benefit from a supportive context for PBL administration' (2000, p. 34). According to Thomas, the effectiveness of PBL as an instructional method may depend, to a greater extent than we recognize, on the 'incorporation of a range of supports to help students learn how to learn' (2000, p.34). One of the ways to support student learning is to include 'scaffolding' which has been defined as 'any method or resource that helps a learner to accomplish more difficult tasks than they otherwise are capable of completing on their own' (Singer, Marx, Krajcik, & Chambers, 2000, in Condliffe, 2015. P.13). Most importantly the scaffolding should be removed over time as the students learn how to apply new knowledge and skills on their own (Puntambekar & Huschber, 2005, in Condliffe, p.14).

2.4 Project-based learning, collaboration and virtual high schools

Some of the factors that may aid or inhibit collaboration and peer-to-peer interaction in this research context have been identified in the review of the key concepts thus far. However, this section focuses specifically on PBL and collaboration literature in a virtual high school context. Limited literature exists on the use of PBL and collaboration specifically in a virtual high school context, and literature based in tertiary settings is more abundant and has been included where appropriate.

The Florida Virtual School (FLVS) was the USA's first 'state-wide, internet-based public high school' to have undertaken and evaluated PBL (White 2012, p.5). White's report was based on interviews with five practitioners from the field and considers two examples of PBL courses at the FLVS (2012). In these courses there were opportunities for students to participate in collaborative activities, but this was not always an essential part of the course, and students could complete assignments without collaboration. One of the key challenges White cites for incorporating collaboration in PBL at FLVS is 'rolling enrolment' (2012, p.7) whereby students from all over the world can join the course at any time. White recommends additional research exploring the use of 'blended learning' solutions for more effective PBL, as well as exploring new technologies and collaboration tools that could aid the efficacy of PBL in virtual high schools. Finally, additional research in the field of online PBL is identified

as essential to understand the 'collective theoretical and practical understandings of how to optimize these approaches and relative importance of the various factors that bear on their effectiveness' (White, 2012, p.8).

Lang (2010) conducted a study on an online PBL in a high school environment, although the medium of delivery was asynchronous, and the project was run in conjunction with students attending brick-and mortar schools. Key findings included a lack of evidence of higher order thinking skills and 'little evidence of construction of new knowledge, critical analysis of peers' ideas or instances of negotiation' (Lang, 2010, p.336). Lang suggests students need to learn more about their 'group roles, demonstrate their involvement systematically (planning, contributing, asking questions and seeking input) and reflect on their learning at the end of each forum, in order to achieve quality learning from their participation in such asynchronous project-based learning' (2010, p.338). Further to this Lang suggests that teachers could 'help and monitor' students to cooperate in groups, however no formal suggestions are offered (2010, p.338).

One of the key components in undertaking PBL and collaboration in a virtual school, which has not been addressed thus far, is the technology needed to facilitate the project development and participant interaction and collaboration. Plenty of literature exists on the use of technology to support PBL as well as technology and collaboration (Chang, 2014; Collis, 1997; Ravitz & Blazevski, 2014). Some of the relevant factors that could aid or inhibit interaction or collaboration include 'permanency of content' (Ellis, 2001), 'accessibility' (Edelson, Gordin & Pea, 1999) and the use of collaborative Google docs (Blau & Caspi, 2009; Spaeth & Black, 2012). According to research conducted by Papanikolaou and Boubouka, factors which affect collaboration in a PBL e-learning context include 'the importance of the design variables considered in the collaboration script for cultivating metacognitive knowledge, such as project phase, roles undertaken by students, degree and type of interaction, type of activities and products, and activity sequencing' (2010, p.135).

In reviewing the literature on online PBL and collaboration it becomes clear that the teacher or facilitator plays a significant role in the success and outcome of the activity. The teacher's role is multi-faceted and includes a role in PBL, supporting collaboration, and the added dynamic of the role of the teacher in an online environment or virtual school. Lang highlights three roles the teacher should play in online activities 'intervening when the students either went off focus, or were stuck with interpersonal and learning issues, fading out when the students were progressing or were on track and making frequent online visits to the forums' (2010, p. 329). Soller suggests that the most effective instructors in such learning environments 'teach students both the cognitive skills necessary to learn

the subject matter, and the social skills they need to communicate well in a team' (2001, p.41). Beldarrain determines that the instructor's role is not only monitoring and facilitating interaction, but that in a emerging technologies context, the instructor will also 'actively participate in the exchange of knowledge and reflection' (2006, p. 149).

2.5 Interaction

Interactions are central to this research study, and whilst collaboration requires interaction, it is more than just peer-to-peer interaction and the support and facilitation of peer-to-peer interaction does not guarantee that collaboration will occur (Murphy, 2004, p.422).

2.5.1 Interaction Types

Moore categorized interaction in distance education into learner-content, learner-instructor and learner-learner interactions (1989). His model has been widely referenced as a framework for understanding interactions in online environment (Borup, Graham, & Davies, 2013; Hrastinski, 2009; Song & McNary, 2011).

Moore's (1989) framework is particularly relevant in this research context as learner-learner interaction, which constitutes peer-to-peer interaction is a clear focus for this study. Peer-to peer interaction is defined in this research study as any interaction between one student and another student, or one student and many students where the teacher is not involved in the conversation. In order to determine the nature of peer-to-peer interaction and whether or not this constitutes collaboration, it is essential to identify the interactions that occur between students, which Moore's (1989) model accommodates.

In addition to this Moore's model allows for learner-content interaction, and Hansen notes that the interaction of the learner and the teacher with an interface is a new element of online interaction that needs to be addressed (1996, in Curtis and Lawson, 2001). Given the online nature of the virtual school context this is an additional consideration in this research context.

2.5.2 Collaboration

Determining a clear definition for the concept of collaboration is important to establish whether or not the interactions undertaken in this study constitute collaboration. However, collaboration is a much-debated topic, with no widely accepted consensus on a definition (Thomson, Perry, & Miller, 2009). The distinction between cooperation and collaboration contributes to the debate, however

Roschelle and Teasley explain, ‘cooperation is accomplished by the division of labour among participants, as an activity where each person is responsible for a portion of the problem solving’ and collaboration as ‘mutual engagement of participants in a coordinated effort to solve the problem together’ (1995, p. 70). It is beyond the scope of this research to entertain and debate all perspectives of collaboration and cooperation, however for the purpose of this study a simple definition will be adopted of collaborative learning as ‘a student-centred approach in which groups of individuals work jointly on a well-defined learning task’ (Lee, 2009, p.150). Drawing upon researchers’ use of ‘collaboration indicators’ or ‘collaboration principles’ (Curtis & Lawson, 2001; Murphy, 2004; Soller, 2001) specifically will be useful to help determine whether or not some of the interaction that occurred constituted some form of collaboration in the PBL activity.

A number of researchers have constructed analytical frameworks to assist in the analysis of their research on collaboration. Curtis and Lawson analysed the content of text contributions in asynchronous online activity and sought ‘utterances that that were indicative of the behaviours that are reported for other forms of collaborative learning’ (2001 p.26). Curtis and Lawson’s indicators were based on the work of Johnson and Johnson and included ‘giving and receiving help, exchanging resources and information, giving and receiving feedback, challenging and encouraging each other, and jointly reflecting on progress and process’ (1996, in Curtis and Lawson, 2001, p.22). A potential issue with Curtis and Lawson’s framework is their use of the category ‘social interaction’ that includes ‘conversation about social matters that are unrelated to the group task’ (2001, p.34). This use of ‘social interaction’ could be misleading, as it could be argued that all interactions between humans are social by nature, and the term ‘social interaction’ has widespread use in the interaction literature encompassing more than just off-topic conversations (Su, Yang, Hwang, & Zhang, 2010, Soller, 2001).

Soller presents the ‘Collaborative Learning Conversation (CLC) Skill Taxonomy’ as a framework for identifying ‘the conversation skills most often exhibited during collaborative learning’ (2001, p.46). The analysis of a study conducted by Soller (2001) focussed on identifying the positive characteristics of interaction that culminate into effective collaborative learning. The taxonomy isolates each learning conversation skill type (Active Learning, Conversation, and Creative Conflict) into corresponding sub skills and attributes. Soller’s study was implemented using a ‘structured communication interface’ which required students to choose the beginning of each online contribution from a list of ‘sentence openers’ or introductory phrases that corresponded with the CLC skills taxonomy before typing their contribution to the online discussion (2001, p.47). The intention of the study was to conduct further research into the possibility of an Artificial Intelligent Collaborative Learning System to promote effective collaborative learning between participants in an online environment. Soller presents an

analysis of two contrasting groups in the study, that of an 'effective supportive group', and an 'unsupportive unbalanced group'. Soller concludes that further work is needed to 'characterise sequences of learning interaction' (2001, p.55) that are indicative of effectiveness and ineffectiveness during group collaboration. An additional contribution from Soller has been her suggestion of strategies that can be used to promote effective peer interaction, including holding round robin brainstorming sessions and 'providing feedback on participant's collaborative skills learning usage' (2001, p.58).

The coding frameworks provided by Curtis and Lawson (2004) and Soller (2001) provide a useful analytical framework for identifying collaborative behaviours and interactions. However, Murphy (2004) also provides a useful framework for evaluating the quality of collaboration taking place. Although measuring the effectiveness of collaboration was not the specific research focus for my study, Murphy's collaboration model (2004) provides a useful framework for interpreting the findings for subsidiary research questions two and three, as well as linking the relationship between peer-to-peer interactions and collaboration which is central in this research study.

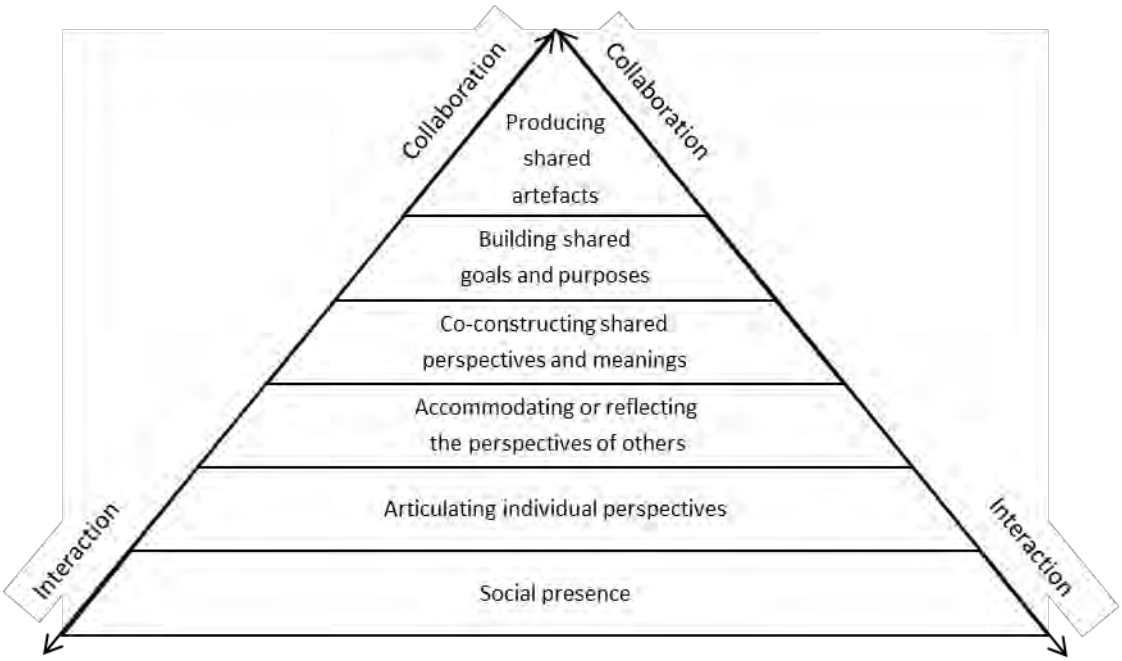

Figure 2.1 Murphy's collaboration model (2004, p. 424)

Murphy's collaboration model provides a hierarchy of interactions or a 'continuum along which six major processes or stages can be identified' with 'producing shared artefacts' (2004, p.423) at the pinnacle of collaborative behaviours (See Figure 2.1). Murphy argues that the lower level processes are a pre-requisite for reaching the higher processes, however participation at the lower level of the hierarchy will not automatically mean the higher levels of collaboration are reached.

2.5.2.1 Social presence and collaboration

Murphy identifies social presence as a pre-requisite level of interaction in the collaboration model (2004). Drawing on Garrison et al., Murphy defines social presence as 'the ability of participants in the Community of Inquiry to project their personal characteristics into the community, thereby presenting themselves to the other participants as "real people"' (2004, in Murphy, 2004, p.422). So and Brush define social presence as the 'psychological degree to which a learner perceives the presence of and connectedness with other learners' (2008, p323). A sense of belonging or presence 'enables students to interact comfortably with peers as well as instructors' (Beldarrain, 2006, p.149). Further to this, Ubon and Kindle suggest that social presence is 'a prerequisite to establishing an online community where students can collaborate' (2004, in Beldarrain, 2006 p.149).

The goal of establishing social presence according to Garrison is to 'create a climate of trust and belonging that will support interaction and a questioning predisposition' (2006, p.26). Forming a 'sense of community' is possible when participants communicate on a social rather than an informational level, and through this process 'interaction can move to a higher level and become collaborative' (Henri, 1992; Garrison et al., 2000 in Murphy 2004, p.423). Murphy identifies indicators of behaviour that generate social presence to include 'sharing personal information', 'recognising group presence', 'expressing feelings of emotion', and 'complimenting/expressing appreciation towards other participants' (2004, p.426). However, in their studies So and Brush issue a word of caution and conclude that there may be an 'optimal level of social presence which positively affects collaborative learning', and it is possible that 'high levels of connectedness' could have a negative impact on collaboration due to increased levels of 'off-topic conversation and socialising' (2008, p.327-328).

In summary, Figure 2.2 provides an overview the conceptual framework utilised in this study and how they relate to the subsidiary research questions.

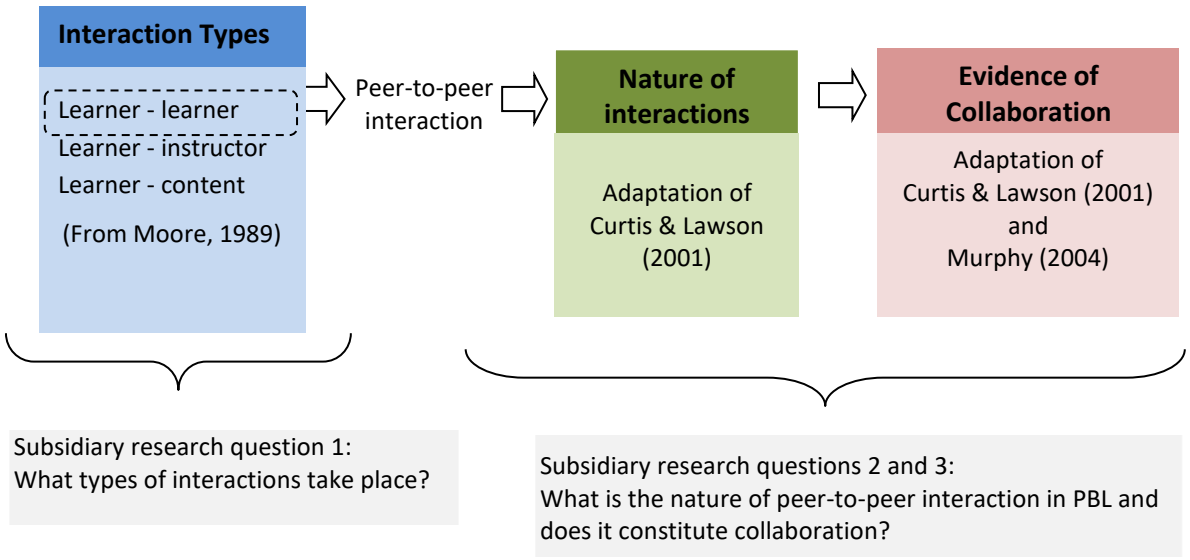

Figure 2.2 Conceptual framework for analysing interactions from the PBL activity

2.6 Summary of literature review

The literature has provided an overview of the key concepts including 'anxious school refusers', 'virtual schools', 'PBL' as well as a literature to form clear conceptual frame for analysing interaction and collaboration. Throughout the literature review factors that may aid or inhibit collaboration in this context have been identified, and the chapter serves as a useful backdrop for framing this research study in the chapters that follow.

3 Research Methods

3.1 Introduction

This chapter reviews the research approach and methods undertaken to complete the study including the site and participant selection. In addition to this, validity and ethical issues are discussed, and a detailed guide of the research procedure is presented.

3.2 Research approach

Easton explains that critical realism is particularly well suited to underpin case study research, if the process involves 'thoughtful in depth research with the objective of understanding why things are as they are' (2010, p.119). This research aims to gain an understanding look at the peer-to-peer interactions and collaboration that occur during Project Based Learning for anxious school refusers in a virtual school. The particularly niche context of this study focuses on a few students attending one virtual school specifically aimed at supporting 'anxious school refusers' and no research has been previously conducted in this environment. The advantage of a case study is eloquently explained by Easton as providing the researcher with the 'opportunity to tease out and disentangle a complex set of factors and relationships, albeit in one or a small number of instances' (2010, p.119). There are multiple factors that could potentially influence outcomes in this particular context, (including the nature of the students, the technological medium of delivery, or the role of the teacher to name a few). Given the niche context, multiple variables and relationships, a critical realism approach allowed for 'continuous cycles of research and reflection' until eventually 'one or more mechanisms' could be identified as possibly having aided or inhibited peer-to-peer interaction and collaboration in this research context (Easton, 2010, p.128).

Whilst different research approaches to case studies have been defined over the years the work of Stake has been well documented (1995, in Baxter & Jack, 2008). With an intrinsic case study, the researcher has a 'genuine interest in the case' and should use an intrinsic approach to understand the particular case better (Baxter & Jack, 2008, p.548). With this approach the purpose is not necessarily to 'understand abstract concepts or generic phenomenon'. This research study utilizes an intrinsic case study in that I am genuinely interested in this particular context and improving outcomes for the students and staff at the organisation. However, in addition to this there are also elements of an instrumental case study. In an instrumental case study, the case itself is not the primary interest, but rather the purpose is to 'accomplish something other than understanding a particular situation' and it 'provides insight into an issue or helps to refine a theory', ultimately helping the researcher to pursue

an external interest (Stake, 1995 in Baxter & Jack, 2008). Through this research, the purpose is to build conceptual frameworks that provide insight into the issues of peer-to-peer interaction and collaboration in virtual PBL contexts, as well as understanding anxious school refusers and how the needs of these young people can be better met globally. As such this case study is both intrinsic and instrumental in nature.

Creswell defines mixed methods research as 'an approach to social, behavioural, and health sciences in which the investigator gathers both quantitative (close-ended) and qualitative (open-ended) data, integrates the two, and then draws interpretations based on the combined strengths of both sets of data to understand the research problem' (2015, p.2). Both qualitative and quantitative methods were necessary to address the research questions underpinning this study. More specifically a 'concurrent' mixed methods approach was deployed which utilises quantitative and qualitative analysis at the same time (Creswell & Plano Clark, 2007). The use of descriptive statistics, which is a form of quantitative analysis, is defined by Cohen, Manion and Morrison as a method to 'describe and present data' which can include 'summary of frequencies' and that this form of statistics makes 'no inferences or predictions, they simply report what has been found in a variety of ways' (2007, p.503-504). In the first subsidiary research question which addresses 'types of interactions' it was necessary to use descriptive statistic, a form of quantitative measure, to conclude totals and frequencies of Interaction Types. The second research question which addressed the 'nature of peer-to-peer' interactions, which required a qualitative approach to determine the nature of the interactions, however quantitative descriptive statistic measures were only used to provide an overall picture of the frequencies of particular behaviours. Excel was the primary tool for analysing the qualitative and quantitative data, and Meyer highlights the advantages of Excel as a qualitative analysis tool as 'it can handle large amounts of data, provide multiple attributes, and allow for a variety of display techniques' (Avery & Meyer, 2008, p.91).

3.3 Selection of site and participants

The participants in this study were drawn from the virtual school RBAir in the United Kingdom, which is the organisation where I was employed at the time the data was collected. The group consisted of ten students (between 12-16 years of age) and two teachers who attend or work at the online school.

A process of convenience sampling was utilised in this research study. Cohen, Manion and Morrison describe this form of sampling as 'choosing the nearest individuals to serve as respondents and continuing that process until the required sample size has been obtained or those who happen to be available and accessible at the time' (2007, p.113 - 114). In quantitative research this form of sampling

is strongly discouraged (Maxwell, 2008), however this method was employed because the participant selection was limited to a niche research context, and furthermore the participants were limited to the students and teachers within this virtual school who were willing to participate in the study. Cohen et. al further highlight that convenience sampling is less problematic when the sample 'does not represent any group apart from itself' and the researcher does not seek to generalize about the wider population (2007, p114.). With this in mind the findings from this study are limited to the niche research context, and in fact to a sample of one PBL activity.

During the third and final term of the school year the teaching staff at RBAir ran a series of projects and students could volunteer to participate. The students who participated in this research study signed up to join the 'Yearbook Project'. I had a telephone conversation with most of the students' parents who wanted to participate in the Yearbook Project, and posted information letters with consent forms to all parents (Appendix 1). Only one parent refused and this student was given the option to attend another project. The teachers and students signed a consent form in order to participate (Appendix 2 and Appendix 3).

3.3.1 The Virtual school

RBAir commenced operation in 2010. A range of technical tools are used to facilitate communication including an Opensimulator based 3D virtual world, a Google Education account, and a number of other software tools that have been extensively risk-assessed. The students tend to work in small groups (ranging from 3 – 8 students) or in one-to-one sessions. In addition to academic subjects, the students also engage in well-being sessions (including online counselling and small therapeutic groups) and community time (including circle time and presentations).

3.3.2 Teachers

The two teachers had both taught at the RBAir for more than six months and had undertaken online training from the organisation in order to make the transition from teaching in a mainstream classroom. They had undertaken the training required to teach online and displayed proficient technical skills to operate in the online school context. Both were trained secondary school teachers (English and Science respectively), and came from mainstream secondary school settings prior to being employed at the organisation. The organisation has adopted a 'negotiated curriculum' approach whereby students have significant say in the content, pace and approach to learning. The teachers would have been inducted into the philosophy and practice of the organisation. Project-based work is common practice in teaching and learning at RBAir, although the training received has been less formal.

3.3.3 Students

The students, aged between 12 and 17 years, had not attended school from between three months to one and a half years prior to joining RBAir. They may have experienced some level of bullying and experience anxiety around the prospect of attending mainstream school. The students had all participated in prior online group sessions and had participated in some classes together at RBAir prior to the Yearbook Project. The average length of attendance at RBAir was from six to twenty-eight months.

3.3.4 The Project Based Learning activity

The research study focuses on the Yearbook Project, which took place in the final month of the academic school year. The aim of the activity was to produce a Yearbook that could be sent to all students in the RBAir community and serve as a record and reminder of the academic year. The project consisted of four sessions of two hours each and students participated synchronously. Teacher1 facilitated the first two sessions and Teacher2 facilitated the final two sessions. Over the course of the four sessions at times the students were engaged with all the students and the teacher (Whole group), and at times they broke into smaller groups. Students were allowed to choose what components they thought should be included in the Yearbook Project, as well as the activity they wanted to work on. Table 3.1 provides an overview of the different components of the PBL activity which unfolded in the four sessions.

Table 3.1 Explanation of the different components of the Yearbook Project

Group details	Session 1	Session 2	Session 3	Session 4	Outcomes
Cover Design (3 students, 1 teacher)	Students discuss design and jointly create a draft, although one student left halfway through due to timetable clash	Students complete front and back covers jointly and discuss other elements to include in the Yearbook	Students move on to different to groups as cover completed	N/A	Jointly created front and back cover design
Wordle (2 students, 1 teacher)	Students discuss what information to put in the Wordle (an online graphics tool see at http://www.wordle.net/)	Teacher supports with brainstorming ideas when contributions stall	Challenges experienced with Wordle plugin, and understanding how to prepare for the graphics tool without access	N/A	Created lists of words for Wordle, but teacher completed task due to technical difficulties
Quotes (1 student, 1 teacher)	Only one student elected to work on this activity, and constructed an email that the teacher sent out to gather info from other students	Student continues to design the page on her own, whilst the teacher prompts other students to reply to info email	Teacher collects outstanding info from various students on behalf of student	Students checks all information is updated, and also contributes to the Mini-centre discussion	Student produced a quotes page, however worked alone on the design
Quiz (2 students, 1 teacher)	Students acknowledge the task was more challenging than they expected it to be and teacher helps with initial suggestions	Students run out of ideas and ask for additional ideas from other students in the 'whole group chat' and another students visits to offer ideas	Third student joins to help with ideas for the RBAir Quiz and the students request the teacher to complete the answers they are unsure of	N/A	Students create a Quiz, although the contributions and effort are not balanced with one student contributing very little
Playlist (2 students, other students join, 1 teacher)	N/A	Students discuss issues such as copyrighting and technical challenges however one student takes the lead without much consultation	Additional students join the group to add information needed for the to create the Playlist	One student pioneers the completion of a list of songs, however the outcome of the original YouTube compilation is unclear	Key challenges and issues are discussed, although students work independently on the task with one student completing more than the other
Mini-centre (3- 6 students, 1 teacher)	N/A	N/A	Students reminisce to find information to provide on the Mini-centre memory page and an issue encountered over inclusion of photographs	Additional memories discussed which results in plenty of tangential conversations	Information about memory page completed with contributions from all students however final design of page not covered
One-to-one (6-7 students in individual conversations with teacher)	N/A	N/A	6 students engage in one-to-one interactions with the teacher for a number of different reasons	7 students engage in one-to-one interactions with the teacher for a number of different reasons	One-to-one chats with the teacher were used for clarification, pleas for help, to communicate emotional difficulties and challenges discuss with the activities
Whole Group (10 students, 1 teacher)	Teacher 1 supports the setup of the Yearbook with ideas from the previous year, and a brainstorming session of new ideas for the current year	Group used to recap on activities before students work in smaller groups	Teacher 2 takes over the Yearbook facilitation	Teacher 2 extracts outstanding information from students in order to complete activities and students can leave once they have completed information	Whole group chat groups used for setting up activities, providing instructions, asking for input from other students, greetings and departures

3.4 Methods of data collection

The data for this study was collected through a number of different instruments that were determined according to the research question addressed. The data collection from the students was limited due to the time of the year and the fact that many of them graduated or left for summer holidays.

3.4.1 Chat transcripts

Garrison, Cleveland-Innes, Koole, & Kappelman propose that 'transcript analysis' is an 'important methodology to study asynchronous online educational discourse' and that 'the permanent nature of online asynchronous text-based transcripts provides an accessible source to study the complexities of the teaching and learning transaction in this environment' (2006, p.1). The concept of 'transcript analysis' extends to this research context, although the medium of delivery is synchronous, the permanence of the the text based interactions from the activities in the Yearbook Project provided valuable primary data to provide insight into the type and nature of interactions that took place.

Key challenges with transcript analysis include: selecting a sound framework, having a clear coding scheme and identifying the 'unit of analysis' within the chat transcript (Garrison et al., 2006). The conceptual framework for this research is outlined in Section 2.5 and builds on the established works of Moore (1989), Curtis and Lawson (2001) and Murphy (2004). The unit of analysis can be determined by unit of analysis 'sentence, paragraph, message, or thematic levels', and for the purpose of this research was identified per participant contribution in the chat transcripts (with some constraints identified in Table 3.4).

The type chat transcripts were collected from all four of the Yearbook PBL sessions. These transcripts captured the participant's name, the sentence they typed, as well as a timestamp of when the person entered the text. The teachers copied the chat transcripts from the four PBL sessions which occurred and pasted them into a document which was shared with me. The transcript data underwent a process of 'de-identification' (in Table 3.4), and was transferred into Excel.

A few issues arose during this process which included the fact that not all the 'emoticons' used in the chat sessions were captured in the cut and paste between software. In addition to this some students started chatting on Google docs before the teacher opened the document and the first few lines of some conversation data may have been lost. Wherever possible the video screencasts (see 3.4.2.2 below) were used to recover any of the lost transcript data, however when there is doubt it is clearly marked on the session transcript.

3.4.2 Secondary data sources

Although the primary source of data to address the research questions were the chat transcripts, a number of secondary data sources were collected in order to better understand the context and cast a wider net to identify the factors that could aid and inhibit collaboration in this context. These include teacher and student questionnaires, video screencasts, lesson resources and artefacts,

3.4.2.1 Questionnaires

Questionnaires come in a number of different forms and can serve multiple purposes employing open or closed questions, depending on the aims of the questionnaire (Cohen et al., 2007). According to Bailey, open ended questions are useful if the 'answers are unknown or the questionnaire is exploratory' (1994, in Cohen et al., 2007, p. 321) and the advantages include the fact that participants can write their account 'in their own terms' and without limitations. Closed questions by contrast require a respondent to select from a range of responses and the limitations include the fact that the list of options may not be exhaustive (Cohen et. al, 2007).

Teacher questionnaire

The teachers were asked to complete a questionnaire that contained only open-ended questions five days prior to the project commencing (Appendix 4). A questionnaire with open ended questions was selected as the purpose of the activity was exploratory in order to gather initial thoughts from the teachers on factors perceived to influence student interaction and collaboration in a PBL session. The added benefit of the questionnaire over initial interviews was that the teachers had extremely busy end of school year schedules, and the questionnaires could be completed in their own time. The questionnaire was completed on a Google document that had the added benefit of ease and convenience for the teachers as it was a medium with which they were very familiar. The reflections gathered from the teachers in these initial questionnaires provide a useful backdrop for interpreting the findings of the research.

Student questionnaires

The students were asked to complete a general questionnaire after the final session about their participation in the Yearbook Project (Appendix 5). The final PBL session was a few days before the students finished their engagement with RBAir or left for the summer holidays, so a short questionnaire containing both open and closed questions was administered to gather initial reflections from students. Closed questions were useful in gathering students' perspective that may have been difficult for them to articulate in words, however open ended questions were included to ensure that students who felt they had more to say were able to do so.

3.4.2.2 Video screencasts

The teachers were asked to record their screen activities during the PBL sessions, which they did using *Sharex,* and automatically uploaded the screencasts to Google Drive. This provided a secondary data set which served as a backup to recover any lost data, as well as providing a better visual understanding of how the lesson unfolded in real time, which is not always immediately obvious from the chat transcript. These screenshots contain a great deal of personal data and information which make them unsuitable to submit as primary data however, they were invaluable in getting a sense of how the sessions unfolded in real time.

3.4.2.3 Lesson resources and artefacts

The teachers and students produced 'artefacts' in the form of documents, slides and drawings that were also collected as a secondary form of data from the four sessions.

3.5 Data analysis method

A process of content analysis was deployed to analyse the data collected in this study (Bauer, 2000). The primary data was the chat transcripts generated in the PBL sessions. According to De Wever, Schellens, Valcke and Van Keer, 'the aim of content analysis is to reveal information that is not situated at the surface of the transcripts' (2006, p.7).

The analysis of the data for the subsidiary research questions addressed drew on the works of Moore (1989), Curtis and Lawson (2001) and Murphy (2004). These frameworks provide a 'coding frame' for the transcript analysis process, however as Bauer highlights, 'constructing a coding frame is an iterative process' (2000, p.138) and through a process of refinement these coding frameworks have been adapted as outlined under each research question below. In some instances, the analysis of the data in this research culminated into a numerical description of the findings from the chat transcripts, indicating frequencies of themes raised in the data. Bauer reminds us however, that although a numerical description of the data is provided, 'considerable thought is given to the 'kinds', qualities' and 'distinctions' in the text before quantification takes place' (Bauer, 2000, p.132).

Excel spreadsheets were used for this process of content analysis of the chat transcripts. Avery and Meyer (2008) advocate Excel as an often overlooked tool for qualitative data analysis, and highlight the advantages including the process for data preparation undertaking analytical coding (including filtering and basic formulae). Excel proved to be an advantageous analytical tool as it enabled me to undertake the essential qualitative analysis, whilst keeping the chat transcript intact, as well as providing an accurate and efficient means for obtaining some quantitative descriptive measures to

provide an overview of the findings. An example of the chat transcript imported and coded in word can be found in Appendix 6.

3.5.1 Type of interaction occurring during the PBL activity for anxious school refusers

Identifying peer-to-peer interaction within the Project Based Learning activity required an analysis of the interactions that took place. Initially Moore's (1989) interaction model was proposed to understand what types of interactions occurred, however it quickly became apparent that this required some adaptation in order to better understand this research context. Although his system catered for the identification of learner-learner or peer-to-peer interactions, distinguishing between one student interacting with more than one student (student-students) was not possible. In my study this distinction was an important factor in determining any nuances between student interaction with one peer or many peers, which could provide an additional level of detail on factors that aid or inhibit peer-to-peer interaction. Secondly, the direction of interaction is not apparent from Moore's (1989) model. For example, although he includes a 'learner-instructor' category, this does not identify the directionality of the interaction i.e. student-teacher or teacher-student. An adaptation of Moore's (1989) interaction model was developed, to incorporate these key aspects (Table 3.2). This system provided the level of detail needed to identify student-student as well as student-students interaction, which collectively account for peer-to-peer interaction.

Table 3.2 Summary of coding labels adapted from Moore (1989) to code type of interactions

Participant	Explanation of interaction	Example from transcripts
student-student	a student's contribution is targeted at another student	'Amy 10:34 Jared you said you couldn't think of any but you have the most' Session1, line 144
student-students	a student's contribution is intended for one or more students	'Calvin - yeh that might make sense, what about u Heather?' Session 1, line 364
student-group	a student's comment is aimed at everyone present in the group discussion including the teacher	'Jared 10:40 what about a page to show off achievements or thing we did that we are proud of' Session 1, line 177
student-teacher	a student comment intended for the teacher in the session	'Rebecca - Teacher1 can you invite Henry to the doc because I can't ☹' Session 1, line 439
teacher-group	Teacher's contribution intended for everyone in the virtual class	'Teacher1 11:08 ok - is everyone happy with the list of things on slide 7?' Session 1, line 293
teacher-student	Teacher's contribution targeted at an individual student	'Teacher1 11:23 Calvin - you can decide in your group' Session 1, line 348
teacher-students	Teacher comments aimed at one or more students however not intended to reach the entire student cohort.	'Teacher1 10:50 Ah, yes, bye bye Colin and Jared - I know you have a session.' Session 1, line 241

It was not possible in this research study to accurately record 'learner-content' interaction, Moore's (1989) third type of interaction, from the chat transcripts, due to the technical limitations of the platform. Nor was it possible to interview students, given the time constraints, and timing of the school holidays.

Adopting a more granular level of analysis of Interaction Types helps to distinguish the 'student voice' (student-student, student-students, student-group, student-teacher) in the transcripts from the 'teacher voice', wherever the teacher is engaging with the students (teacher-student, teacher-group, teacher students). This directionality and identification of student versus teacher voice informed identifying some of the possible factors that may aid or inhibit peer-to-peer interaction and collaboration.

The chat transcripts were imported into Excel and all 2422 lines of participant contributions from the four PBL sessions were coded with one of the coding labels identified in Table 3.2. The challenge I experienced with this coding process was that in some instances it was not always clear to whom a comment/contribution was being directed. For example, sometimes a teacher started a session to a whole group, and all the students reply 'hi'. It is not clear if student replies are directed at the whole group or whether they are in fact just replying to the teacher. In such instances, I made assumptions that it would be likely one would give a general greeting (i.e. student-group) and standardised the coding for all the sessions to mean the students were saying hi to the whole group and coded it as such.

Additionally, sometimes the students were conversing with each other in small groups when the teacher would intervene and answer a question that a student may have been intending for another student. Retrospectively it looks like the comment is between student-teacher, however it is possible it was initially student-student interaction. In such instances I have sought a second opinion on the coding, although there is still margin for error. In some ways, the challenges experienced in identifying the Interaction Type and the role of the teacher helped to provide some additional insight on potential factors that aid or inhibit collaboration and this is discussed in Chapter 4.

3.5.2 The nature of peer-to-peer interactions and collaboration during the PBL activity

Similarly, to Research question 1 the data analysis method to address the two subsidiary research questions also included transcript analysis of chat transcripts. In Chapter 2 a number of conceptual frameworks for analysing collaboration where presented (Soller, 2001; Curtis & Lawson, 2001; Murphy, 2004). The criteria for selecting a framework for this research included, 1) a framework that was simple enough to apply to the high school student's chat transcripts 2) would identify the presence or absence of collaborative behaviours in conversations that occurred, 3) would provide a basis for recommendations for further research, feedback for the organisation.

Initially Soller's Collaborative Learning Conversation (CLC) Skill Taxonomy (2001) was considered to be a suitable coding framework, however during an initial trial on the transcript data the difficulties were twofold. Firstly, the complexity and level of abstraction of Soller's taxonomy, developed in a tertiary education context, was difficult to apply to the short, often less sophisticated responses of the high school student participants. As Garrison et al notes, 'complex models and coding schemes may provide new insights but can have a negative effect on reliability and validity' (2006, p.2). Although many of Soller's categories provided some insight, some of the sub-categories incorporated were rendered redundant. The difficulty in applying Soller's coding scheme to the transcripts could be indicative of the lack of collaboration conversations taking place between students. However, the concern was that in fact the complicated system would overshadow whatever elements of collaboration were taking place in a less sophisticated educational setting. Secondly, Soller's (2001) coding scheme provided no clear coding for 'off-topic', or 'tangential-conversational' interactions between students. Off-topic and tangential interactions form a notable portion of interactions in this research study and Curtis and Lawson's (2001) framework provided a more applicable interpretation of the concept for this research study.

In order to establish the nature of student interactions an adaptation of Curtis and Lawson's (2001) interaction coding was used to establish a coding structure. Curtis and Lawson include 'social interaction' as one of their coding categories, which they define as 'conversation about social matters that are unrelated to the group task' (2001, p.34) In Chapter 2 the issue was raised with Curtis and Lawson's use of 'social interaction' being a widely used term that is not only associated with off-topic interactions. This resulted in altering the category to 'Social/relationship-building', and the range of behaviours under this category were extended to include Gratitude, Tangential/conversational, Greeting/goodbye, Off-topic, Unsure/confusion, Humour, and Positive praise that better represented the full range of behaviours identified in the chat transcript. Curtis and Lawson's framework was simple enough to apply to the chat transcripts of the high school students. This coding framework

identified behaviours that could be identified in the chat transcripts. Additional coding labels were added when a particular line in the transcript data could not be adequately covered by the existing labels, and appeared frequently enough to justify an additional code. The additional coding labels included Agreement, Acknowledge, Accommodate/compromise, Clarification seeking, Gratitude, Tangential/conversational, Unsure/confusion, Humour, Off-topic, and Positive praise.

Table 3.3 provides summary of the coding framework developed to analyse the nature of interactions and provides a definition for each sub-category and an example from the transcript text.

Table 3.3 Coding adapted from Curtis & Lawson (2001) to determine nature of interactions

Category	Sub-category	Definition	Example from text
Planning	Organizing work	Planning group work; setting shared tasks and deadlines, making design decisions	Rebecca: how are we setting it out? or are we just leaving it like that?' (S2 L508-509)
	Initiating activity	Setting up activities such as chat sessions or shared documents to discuss the progress and organisation of group work,	Teacher1: You can use this text box to share ideas - start a doc, think about what to put in the quiz together, etc. (S1,L432)
Contributing	Help giving	Offering help when someone needs assistance, responding to questions and requests from others	Teacher1 11:39 I can help out with the answers, if you think up questions' (S1,L 453)
	Feedback-giving	Providing feedback on proposals/ ideas or suggestions contributed by others	Amy 11:52 it would be good if the black wasnt there' (S1, L403)
	Exchanging resources	Exchanging resources and information to assist other group members	Colin 10:56 also (*Inserts link to youtube example he has found to share with his group) (S2, L586)
	Suggestion	To offer an idea or plan to put forward for consideration, which an individual puts forward unprompted by another person	Amy: Should we just put it at RBair 2015 yearbook because its going to be a yearbook nto just a project' (S1, L415)
	Instruction	Issuing a direct instruction to another person or group	Teacher1: You can go to Drive, click new, click upload (S2, L364)
	Sharing knowledge	Sharing knowledge and information with others	Teacher1: I think about 20 times makes it huge, 10 times is quite big and 5 is fairly big etc' (S2,L427)
	Challenging others	Challenging the contributions of other members which could lead to negotiation and resolution	Heather: Please I can't have pictures of me (S3, Line 777)
	Agreement	Confirmation that you agree with the statement, idea, suggestion, proposed by someone else	Heather: Yeah, I think that's a good idea (S1, L365)
	Acknowledge	Letting others know you have read/noted their instruction/contribution	Maryjane 10:17: trying to think of ones (S3, L499) Maryjane 10:35: oh ok (S3, L533)
	Elaborate/ explain	To provide additional explanation on an idea/contribution made in order to explain further	Amy 11:59 because its a bit dark to see' (S1, L419)
	Accommodate/ compromise	To offer some resolution of compromise to a difference in ideas/opinion, often following 'challenging others' interaction	Sophie: okay we dont have to add those we can keep the ones we both had i dont mind' (S1,L502)
Seeking input	Help seeking	Seeking assistance/help from others	Colin 11:13: Could you ask Maryjane to rethink the script? (S4, L157)
	Feedback-seeking	Seeking feedback on contribution made to advance the position of the group/task/project	Amy 11:57 how does that hot air balloon look?' (S1, L411)
	clarification seeking	Requesting more information in order to clarify understanding or instruction	Joanna • 30 mins okay so not teachers too? (S1, L511) Rebecca 11:16 what do you mean by head? (S2, L500)
	Advocating effort	Urging/ encouraging others to contribute to the discussion/project or group effort	Rebecca: H do you want to add anything to the second page? or change anything' (S2, L528)

Reflection/ monitoring	**Monitoring group effort**	**Contributions about the group's processes, achievements and what still needs to be done to complete the assignment**	**Rebecca 11:15 (emoticon) we only need a few more but our minds have gone blank haha(S2,L498)** **Maryjane 10:14 if we could thing of more it would be good (S3,L486)**
	Reflecting on medium	Comments about the effectiveness of the medium in supporting group activity, including technology and how resources needed to complete the project?	Sophie 11:33 i think i cant do a link right now coz the wifi im with has an education filter on it (S3,L388)
Social /relationship building	Gratitude	To express thanks to another person	Colin 11:30 thanks guys (S3, L374)
	Tangential/ conversational	The topic is not completely off-topic as related to the task at hand, but tends to be more conversational or a slight segue from the actual task	Heather 11:55 I found a hot air balloon that looks like a strawberry!!! Amy 11:55 haha what? Heather 11:56 let me show you How cool is that? I'll get rid of it now (students were looking for a hot air balloon and found a different sort that was not entirely appropriate, but was a chance to have some social interaction (S1, L404-407)
	Greeting/ goodbye	Greeting or farewell comments made, also a means of acknowledging presence or departure	Teacher3 11:52: See you next week (S3,L480)
	Off topic	A contribution made that is completely unrelated to the current discussion, or not going to progress the project	Jared 10:41: Im getting mine room done with loads of old comics as my wallpaper (S3, L334)
	Unsure/ confusion	To express being not sure or confused about something relating to the task at hand. Not necessarily a request for help	Sophie 11:36 yeah im good im not sure what words to do though' (S1,L479) Amy: im not sure what to do for the back' (S2, L296)
	Humour	Expression of laughter/ humour or joking	Rebecca 10:47 dang it haha' S2, L479
	Positive praise	Recognising and affirming the good work/ contributions of others	Teacher1 11:38 That's a good idea' S1,L482' Amy 11:14 these are good' S2, L497

Admittedly there are complications and limitations with this coding system identified, including the relative subjectivity of interpreting the meaning or intention of some of the interactions, however this research serves as a useful preliminary investigation into the nature of the student to student interactions.

In order to interpret the findings from the transcript analysis Murphy's (2004) collaboration coding was used in conjunction with Curtis and Lawson's (2001) adapted model to illustrate the discussion of the findings, as well as make some recommendations for future researches and development at RBAir.

3.5.3 Factors that aid or inhibit collaboration during PBL activities in a virtual school

The four session chat session transcripts and subsequent analysis, questionnaire responses and additional artefacts collected, were analysed using open-coding and summarised under six different themes, with multiple subthemes. These themes are not exhaustive but provide a basis for discussion on the findings of the research study and have been presented in Table 4.16.

3.6 Validity

There are some inherent aspects of this research design that limit the validity of this exploratory study. This study employed a mixed methods approach, and in qualitative research it is not possible to implement controls and lessen all threats to validity before the study has begun. Instead a qualitative approach must deal with validity threats as they arise by using evidence collected to make the 'implausible hypotheses' plausible (Maxwell, 2008, p.240).

3.6.1 Bias

Researcher bias refers to 'ways in which the data collection or analysis are distorted by the researcher's theory, values, or preconceptions' (Maxwell, 2008, p. 243). I have a genuine interest in PBL as a different model for online delivery, as well as ways to enhance collaboration and social interaction, however this research journey is to ascertain how viable these options are. I have acknowledged this in order to help minimize the possibility of preconceived ideas influencing the research outcomes in any way. Consultation and reflection with my supervisor and colleagues on the data collection and analysis has helped to minimise the inherent researcher bias.

Comparison is also an effective tool identified by Maxwell (2008) as a means to compare data with existing outcomes in the literature. Although limited literature exists specifically on anxious school refusers and collaborative PBL experiences in a virtual school, I have attempted to provide some literature that could offer more concrete comparisons to increase the validity of the findings.

3.6.2 Sample Size / generalisability

The sample size for the study is very small (two teachers and ten students) which limits the generalisability of the study, from what is a particularly niche group. As Maxwell states, 'the generalizability of qualitative studies is usually based not on explicit sampling of some defined population to which the results can be extended, but on the development of a theory that can be extended to other cases' (2008, p. 246). The in-depth case study and findings produced by this research can be built upon by further research.

3.7 Ethics

An ethical consideration to acknowledge in this context is that as the researcher I was employed by the organisation at the time of data collection, from the period of September 2009 until October 2015, and in addition to this the organisation has contributed toward tuition fees for my dissertation. This is a significant ethical concern, however it is worth highlighting the culture of the organisation is such that genuinely understanding processes and outcomes in order to improve outcomes for young people is a huge driver within the organisation to undertake research and evaluate work in order to learn. The outcomes from this study will have no financial implications for the charity.

In addition to this, my employment at the organisation (in a senior management role) could in some cases be problematic for participants to speak freely about PBL experiences. All participants were given the opportunity to 'pass' on certain questions, and organisational structures are in place for participants to report any issues to a senior level executive.

The research was given ethical clearance from the School of Education. As is required parental consent was obtained for all the students who participated in the study, and information clearly outlining the intended purpose of the research was provided. The data collected has been de-identified through the use of pseudonyms, but due to the small sample size respondents may be able to identify some utterances.

3.8 Research procedure

The table below summarises the research procedure undertaken in greater detail. Although the table is presented sequentially, it is worth noting that within a critical realist paradigm the steps were not that linear and many sections were revisited and revised

Table 3.4 Summary of research procedure

Step	Activity	Description	Date
1	**Parent letters & consent forms**	Issued to parents via post with self-addressed return envelope (See Appendix 1)	26/05/2015
2	**Teacher open questionnaire**	The two participating teachers were given five days to complex the questionnaire in Appendix 4	11/06/2015
3	**Student consent forms**	See Appendix 3	15/06/2015
4	**PBL session 1**	Teacher1 copied chat transcripts and saved screenshot video recordings.	15/06/2015
5	**PBL session 1 - data cleaning and 'anonymising'**	The chat transcripts were all shared in Google doc which included profile pictures, and formatting issues (e.g. many lines, incorrect alignment). Data cleaned & anonymised in a Word document using find & replace tool. Data imported into Excel. An example of the de-identified chat transcript can be found in Appendix 6.	17/06/2015
6	**PBL session 2**	Teacher1 copied chat transcripts and saved screenshot video recordings.	24/06/2015
7	**PBL session 3**	Teacher2 copied chat transcripts and saved screenshot video recordings.	30/06/2015
8	**PBL session 4**	Teacher2 copied chat transcripts and issue experienced with saving video recordings so none recorded for session 4.	07/07/2015
10	**Data cleaning & anonymising**	Process in step 5 completed for transcripts for sessions 2,3 and 4	July 2015
11	**Excel data analysis**	Cleaned chat transcripts were transferred to a spreadsheet. The scripts were read several times and it became apparent that it would appear as though some participants spoke more than others due to their 'typing style', correcting their own errors, and pressing 'enter' more frequently. In order to be fair the following rules applied to grouping the data into a single spreadsheet cell (representing 1 line of coding) 1) If a participant corrected an error directly after making it, it was included in the same cell. 2) If a participant gave more than one contribution in a row, they were only consolidated into one cell if they were the same instruction, or could be considered to be the same theme. 3) If a participant presses enter in between naming several items in a list it was consolidated into one cell.	July 2015

		Once the above was finalised I inserted line numbers for each row in the session transcript. Each line in the transcript became a unit of analysis	
10	**Transcript analysis: 'Type of interactions' coded (Research question 1)**	Type of interactions were assigned to each interaction for all the lines in the chat transcript using the adaptation of Moore 1989 presented in Table 3.2. The coding label was inserted in column E on each of the four session transcripts (each in a separate sheet in the workbook) Series of analysis undertaken on the data analysing per session, per small group and per participant.	August 2015
11	**Transcript analysis 'Nature of interaction' coded (Research question 2)**	Having established in step 10 that a higher concentration of peer-to-peer interactions occurred in smaller groups, only the smaller group transcripts were coded. Initially Soller (2001) was applied, but due to significant challenges (identified in Chapters 2 and 3) Curtis and Lawson (2001) was developed to include additional sub-categories.	Sept 2015
12	**Evidence of collaboration (Research question 3)**	Curtis and Lawson's (2001) framework is based on collaborative behaviours, and although the findings and discussion with this framework were informative, Murphy (2004) was sought to provide a clearer framework for interpreting the results from research question 2.	Oct- Dec '15
13	**Factors that Aid or inhibit (Overarching research question)**	Although this step is chronologically placed here, it was developed throughout the data analysis as potential factors arose during the process. The transcript analysis played an important role in determining these factors, but the secondary data was also analysed to identify additional factors.	Aug 15 -Jan '16
14	**Literature review**	Key concepts identified in literature review written up, although returned to the literature review several times as the findings and discussions sections updated	Sept '15
15	**Findings & discussion**	Initial attempts to write up the findings and structure the discussion.	Nov '15
16	**Final Write up and hand in**	A cyclical procedure of writing up, returning to the data and refinement resulted in the final product.	Nov '15 – Jan '16

3.9 Summary of chapter

This chapter focussed on the research methodology used in this study, with particular attention paid to critical realism and the case study (Easton, 2010). Although not particularly focussed on a critical realist paradigm, the use of both Intrinsic and Instrumental case study approaches are explained. The use of a mixed methods (Creswell, 2015) is described and how use of both quantitative descriptive statistics (Cohen et al., 2007) were necessary alongside a qualitative approach to gain an in-depth understanding of the research context. The chapter outlined the data collection methods in detail and provided a clear overview of how the data for each research question was analysed. The findings from this analysis is presented in Chapter 4.

4 Findings and discussion

In this chapter the findings from the data analysis are presented and discussed in detail according to each research question, and it concludes with a discussion of the overall findings. A brief synopsis of each group activity that occurred during the PBL sessions is provided below, which provides a useful backdrop for the findings and discussions which follow.

Cover Design - The students co-produced a design for the front and back covers of the Yearbook. The possible reasons for the high levels of peer-to-peer interaction in the Cover Design group have been highlighted in Section 4.1, including the fact that two of the students in the group had been at RBAir the longest. A high degree of familiarity with each other may also contribute to the effectiveness of collaboration for this group.

Quiz - Students produced a list of questions, although mostly comprised of individual ideas collated on a page. The interactions could have been influenced by the nature of the design, which was not that sophisticated, which points to nature of the task/activity influencing opportunities for collaborative behaviour.

Wordle - The students discussed a list of words to create the Wordle, however the teacher completed the task due to some technical constraints with operating the software. This highlights technical difficulties hindering production of shared artefacts.

Quotes - Only one student chose this activity, which made collaboration irrelevant for this student. The high levels of student choice at RBAir on activity and process could impact on opportunities for peer-to-peer interaction and collaboration, however this will need to be investigated further with additional research.

Playlist - Students discussed how to construct a playlist at length, including copyright and technical issues. Ultimately one student created the list, and students seem work independently on the completion of the activity.

Mini-centre - This group co-produced a page that reflected their time together when they met face-to-face with a regional mentor in their area.

4.1 What type of interaction occurs during the PBL activity for anxious school refusers?

In order to address this research question, the data from the text chat transcripts were coded according an adaptation of Moore's (1989) interaction analysis. These seven Interaction Type labels include: student-student, student-students, student-group, student-teacher, teacher-group, teacher-student, teacher-students (see Table 3.2 for explanation of each). In total there were 2422 lines from the chat transcripts over the four sessions. Each transcript line was coded with one of the seven labels identified above, and the number of interactions per category were calculated as a percentage of the total number of interactions (e.g. student-group/ total no interactions = 256/ 2422 = 10.6%). Table 4.1 shows that the student-student interaction was the most frequent Interaction Type that took place during the Yearbook project (26.5%), followed closely by student-teacher (24.4%) and teacher-student (20.6%) interactions. The remaining four categories were less frequent with student-group (10.6%), teacher-group (7.3%), student-students (5.5%) and teacher-students (5.2%) respectively.

Table 4.1 Summary of Interaction Types for all the chat transcript data: Yearbook Project

		Totals	
Interaction Type		**No. of interactions**	**% of total contribution for sessions**
student-student		641	26.5%
student-students		132	5.5%
student-group		256	10.6%
student-teacher		591	24.4%
teacher-group		177	7.3%
teacher-students		127	5.2%
teacher-student		498	20.6%
Total contributions		2,422	100.0%
Peer-to-peer	student-student & student-students	773	31.9%
Student voice	student-student & student-students & student-group	1,029	42.5%
Teacher voice	teacher-group & teacher-students	304	12.6%
One-to-one student & teacher	Teacher-student & student-teacher	1,089	45.0%

In addition to the seven Interaction Types identified above Table 4.1 also summarises peer-to-peer interaction, the total frequency of student voice and teacher voice in groups, as well as the number and frequency of interactions on a one-to-one basis between student and teacher throughout the Yearbook Project. This research project primarily focuses on peer-to-peer interactions (student-student and student-students), and these interactions account for 31.9% of all interactions that took place. It is still important however, to interpret the findings from the other Interaction Type as the relationships between the categories have an influence on the peer-to-peer interaction.

The different Interaction Types in Table 4.1 were further dissected in three different ways to allow for further analysis and insight, as illustrated in Figure 4.1.

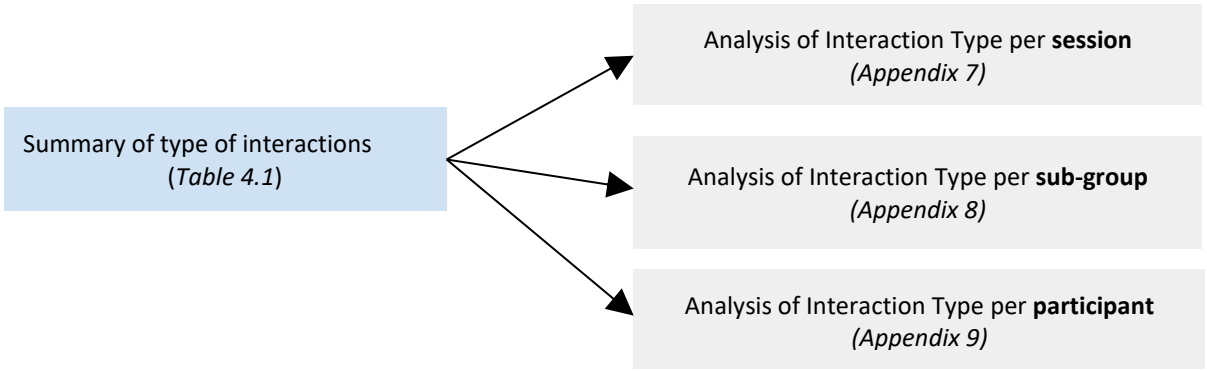

Figure 4.1 Illustration of how data from has been further analysed

The 2422 lines of the chat transcripts collected during the Yearbook Project have been dissected by session (Appendix 7), by the different smaller sub-group activities (Appendix 8) which emerged over the sessions, and finally by participant (Appendix 9). For each of these three tables, a total number of interactions per Interaction Type is provided, as well as a percentage which indicates the prevalence of that Interaction Type within that session/group or for the participant. For additional information on how the figures for the tables in the appendices were calculated refer to Appendix 11.

The nature of these peer-to-peer interactions is equally important to evaluate and will be addressed in research question two, however with the data from the tables in Appendix 7 to Appendix 9 a number of observations about this Interaction Type can be discerned.

4.1.1 Session analysis

The concentration of peer-to-peer interactions during the different sessions varied from 21.5% in Session 1, to 33.4% in Session2, and 38.8% in Session3 and finally reduced to 27.4% in Session 4 (See table in Appendix 7). The sessions with fewer student-student interactions can be explained by slightly different reasons, but both potentially relate to the stage of project development, as well as the role of the teacher. The higher proportion of peer-to-peer interactions in Sessions 2 and 3 occur when the students split into smaller groups, however there is still notable variance in peer-to-peer interaction in these different groups which is addressed in greater detail under 'group analysis' below.

Session 1 has the lowest percentage of peer-to-peer interaction (21.5%), and this is likely due to the fact that the teacher (Teacher1) provided significant structure and guidance to the whole student group who were led through the planning of the Yearbook. A significant number of instructions and scaffolding questions are posted by the teacher (illustrated in by excerpts in Table 4.2) that resulted in more interactions between teacher-group (19.1%) and student-group (19.9%) in Session 1 than peer-to-peer interaction.

Table 4.2 Examples of teacher instructions from Session 1

Teacher1: If you click on slide two, there is a rough outline of what we'll be doing together over the next sessions. We made a yearbook at RBAir last year, so there were a few ideas that we've started off with. (Session1, line 69)
Teacher1: Are these questions ok or can we improve on these? (Session1, line 76)
Teacher1: What do you think about having some interactive bits, like some games in there too? (Session1, line 187)

It is worth noting too that of the 21.5% peer-to-peer interaction in Session1 over 78.7% of these interactions took place once the students moved to smaller groups, however the initial teacher-group instructions helped to set up these smaller group interactions and the resulting peer-to-peer interaction.

Further to the lower peer-to-peer interaction in Session 1, a lower number took place in final Session 4. In this final session Teacher2 was ensuring that all outstanding information was collected from students, and that the tasks were completed. The teacher played a direct role in extracting information from students to complete activities, and this is noted by the 28.2% of teacher-student and 30.5% of student-teacher interactions which took place in Session 4.

4.1.2 Group analysis

In Sessions 2 and 3 the student-student interactions increase to 32.4% and 32.7% respectively (Appendix 7) and this is largely attributed to the fact that the students split into smaller groups to work on tasks they had chosen to work on, namely Cover Design, Quiz, Wordle, Quotess (although this ended up with only one student), Playlist and Mini-centre groups.

The Cover Design group had the highest concentration of student-student interactions (57.8% of the 161 interactions that took place within the group), which was followed by 45.7% in the Mini-centre and 44.0% for the Playlist group (Appendix 8). There could be a number of underlying reasons for the high number of peer-to-peer interactions in these three groups. The Cover Design group had two students who had done a considerable amount of group work together, suggesting that previous experience and confidence working with others might be a factor that increases peer-to-peer interaction. The Mini-centre group had the opportunity to meet face-to-face for a few hours a week with a regional mentor as they lived the same area. Such blended opportunities could play a role in increasing peer-to-peer interactions, however this may be better understood when the nature of peer-to-peer interactions in small groups is addressed in the next research question. The reason for higher levels of peer-to-peer interaction were less apparent for the Playlist group at this level of analysis. However, further analysis of the nature of interactions may point towards many students having an opinion on this, and the challenges faced during the task, which sparked plenty of interaction and debate.

4.1.3 Participant analysis

Examining Interaction Type per participant in Appendix 9 shows that some students undertook more peer-to-peer interaction than others. The graph in Figure 4.2 plots the student's percentage of interaction spent in peer-to-peer interactions during the Yearbook, over the number of months they had attended RBAir.

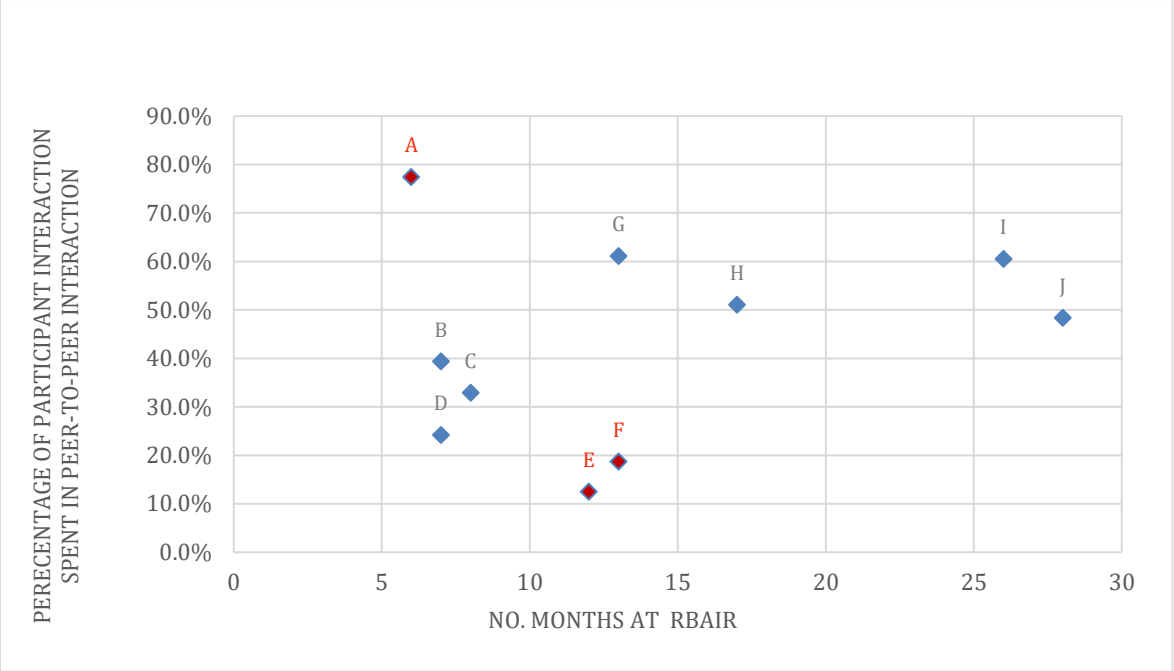

Figure 4.2 Student peer-to-peer interaction and time at RBAir

The graph shows that 4 out 6 students who had been at RBAir for more than a year spent close to 50% or more of their time in peer-to-peer interaction. This could indicate that the amount of peer-to-peer interaction undertaken by a student increases over time at the virtual school and with familiarity of the context. This possible trend of increased peer-to-peer interaction is positive for these students who may have experienced high levels of social isolation and high levels of anxiety in interacting with peers at the point of entry to RBAir. There are however three outliers to this possible trend that are worth expanding upon (point A, E and F in Figure 4.2). Most notably, one student had been at RBAir for the least amount of time, but spent the highest percentage of their time in peer-to-peer interaction. One of the possible explanations is that in small group work, this student was paired with two students who had been at RBAir for the longest. It is possible that pairing with students who have been at the school for longer may help to increase the peer-to-peer interactions. Table 4.3 shows how one student (Calvin) seeks to include feedback from a newer student (Heather) who has not yet commented on an idea of another student (Amy).

Table 4.3 Extract from Cover Design group,

Line	***Session1***	***Interaction Type***	***Nature of interaction***
362	*Amy • 32 mins I think use slides because its easier to move stuff on there than on a word doc*	*student-students*	*Sharing knowledge*
363	*Calvin • 32 mins ok den*	*student-student*	*Agreement*

364	*Calvin • 32 mins yeh that might make sense, what about u Heather?*	*student-student*	*Advocating effort*
365	*Heather • 31 mins Yeah, I think that's a good idea*	*student-student*	*Agreement*
366	*Calvin • 31 mins shall i make the doc then?*	*student-students*	*Initiating activity*
367	*Amy • 31 mins Yeah okay*	*student-student*	*Agreement*

The remaining two outliers from Figure 4.2 relate to students who do not appear to engage in much peer-to-peer interaction given the length of time at the organisation (Point E and F). One of these students chose an activity for the Yearbook that no one else selected, as a result she was the only student who worked on an activity independently (Point E). This highlights a tension between promoting high levels of student voice and choice over activities possibly reducing opportunity to work with other students.

The other instance (point F) highlights a student who was experiencing emotional difficulty engaging with the activity and with other students. This student showed the second lowest concentration of peer-to-peer interaction, and the highest concentration of student-teacher interactions during the Yearbook project with (74.5% in Appendix 9). On occasion this student struggled to engage with activities (example in Table 4.4), and provides an example of when the emotional well-being of this cohort of young people can affect interactions with peers.

Table 4.4 Student interacting with the teacher

Line	***Transcript Session3***	***Interaction Type***
850	*Teacher2: Would you like to help Amy and Heather make a Mini-centre thing?*	*teacher-student*
851	*Student1 • 10:07 I havent got a clue what that is*	*student-teacher*
852	*Teacher2 10:08 It's nothing yet*	*teacher-student*
853	*Studen1t• 10:08 Ill try but i dont know if ill be usefull at the slightest..*	*student-teacher*
854	*p tired and ill today lol*	*student-teacher*
855	*Student1 10:08 You will be*	*teacher-student*
856	*Aaaah what's wrong?*	*teacher-student*
857	*Student1 • 10:09 Alot to think about, so i didnt sleep*	*student-teacher*
858	*Plus ive got a cold*	*student-teacher*

On one occasion Student1 approached the teacher in the session and asked to be excused from the task highlighted in Table 4.5

Table 4.5 Example of student requesting to not participate in an activity with other students

Line	***Session3***	***Interaction Type***
881	*Student1 10:41 What is this centre thing for by the way*	*student-teacher*
882	*Teacher2 10:41 The Yearbook*	*teacher-student*
883	*Student1 10:41 Amy just asked what to do.. but i dont really know alot*	*student-teacher*
884	*Student1 47 mins Do i have to do this :L*	*student-teacher*
885	*Teacher2 47mins What's wrong?*	*teacher-student*
886	*Student1 47 mins Not a fan of looking at the past*	*student-teacher*
887	*Teacher2 45mins Ok, want to help with the playlist then?*	*teacher-student*
888	*Student1 45 mins Idk*	*student-teacher*
889	*Teacher2 44 mins: ok, what about a specific time at the Mini-centre where you have really laughed*	*teacher-student*
890	*It's nice to look back on good things sometimes*	*teacher-student*
891	*Student1 44 mins IT just makes me think id want it back*	*student-teacher*
892	*Teacher2 44mins: Ah I get it*	*teacher-student*

The other students who worked with student1 in the Quiz and Mini-centre group tried to engage this student on a number of occasions, however the student did not oblige as highlighted in one of the examples in Table 4.6 where Student 2 tries to engage this student (student 1).

Table 4.6 Example of one student attempting to engage another student

Line	***Session2***	***Interaction Type***
480	*Student 2 11:05 how many question do we need?*	*student-teacher*
481	*Teacher2 11:06 Maybe 10 or 12?*	*teacher-student*
482	*They are nice round numbers*	*teacher-student*
483	*Student 2 11:08 only a few more*	*student-teacher*
484	*can we ask the others if they have any suggestions?*	*student-teacher*
485	*Teacher2 11:08 Sure*	*teacher-student*
486	*That's a good idea*	*teacher-student*
487	*Student 2 11:09 Student1 do you want to do that?*	*student-student*
488	*Student 1- 11:10 I dont mind the idea*	*student-student*
489	*but doing it myself lol.* *im good*	*student-student*

This appears to be one of the tensions in working with this cohort of young people for the teacher, between pushing them to engage with other students, whilst remaining empathetic to the emotional difficulties they may face. The emotional state of a student plays a role with students engaging in peer interaction.

4.2 What is the nature of the peer-to-peer interaction that occurs during PBL for anxious school refusers?

The data analysed in relation to research question one shows a substantial number of peer-to-peer interactions occurred during the creation of the Yearbook (31.9% from Table 4.1). In this second research question the aim is to provide some insight into the nature of the peer-to-peer interaction that occurred during the activities and whether or not the peer-to-peer interactions constitute a notable form of collaboration. Given that the higher concentration of peer-to-peer interactions arose from the smaller sub-group activities, the interactions from the smaller group activities have been further coded to determine the nature of these interactions. An adaptation of Curtis and Lawson's (2001) framework (Table 3.3) was utilised to code these interactions in order to provide insight into the nature of the peer-to-peer interactions.

In Appendix 10 a table summarising the nature of interactions for students from the smaller group activities is provided, including the Cover Design, Mini-centre, Playlist, Quiz and Wordle groups. The Quotes group only had one student and has therefore been omitted from his analysis. A high proportion of student interaction time in small groups is spent 'contributing' (42.1%). The 'social/ relationship building' category was a close second comprising 39.0% of interactions, followed by less time spent seeking input (11.7%), 'planning' (3.0%) or on 'reflection/monitoring' (3.8%). It is possible that the lower percentage categories could be attributed to the difficulty in identifying interactions that fit these labels, however further research will be required to determine if this is the case.

The overarching categories cited above, provide an overview of the nature of interactions in the smaller group activities, however the detail of the sub-categories in Appendix 10 provides a clearer understanding of the nature of student interactions, which are discussed in detail under the various headings below addressing some of the highest and lowest frequency interactions displayed by students in groups.

4.2.1 Tangential/conversational and off-topic interaction

The highest interaction sub-category in the smaller group activities were the 'tangential/conversational' sub-category, which accounted for 17.4% of the total number of interactions (846). This sub-category was an addition to Curtis and Lawson's (2001) coding system and is defined as a contribution whereby 'the topic is not completely off-topic as related to the task at hand, but tends to be more conversational or a slight segue from the actual task' (Table 3.3). For example, in the Quiz group in Session 3 the Quiz includes some questions about students' pets, where Rebecca has put information about her pets and Amy proceeds to ask for more information. The conversation unfolds in the extract in Table 4.7, where Amy extends the conversation to offer additional information about her own pets. It is not possible to label this interaction as completely off-topic as the Quiz includes questions relating to pets which students are contributing to on the document. However, the tone is more conversational and students share information that could be relevant to the Quiz, but it is also an opportunity to get to know each other and build relationships.

Table 4.7 Extract from the Quiz group transcript

Line	***Session3***	***Interaction Type***	***Interaction code***
599	*Amy 10:13 what are their names?*	*student-student*	*Tangential/conversational*
600	*Rebecca 10:14 They dont have names yet*	*student-student*	*Tangential/conversational*
601	*we have 2 girls and 2 boys*	*student-student*	*Tangential/conversational*
602	*Amy 10:14 aw cute!!*	*student-student*	*Tangential/conversational*
603	*My Mum and Dad used to have one ages ago and his name was Chilli*	*student-student*	*Tangential/conversational*
604	*Rebecca 10:15 awww*	*student-student*	*Tangential/conversational*
606	*Amy 10:15 :)) Have you not had them long?*	*student-student*	*Tangential/conversational*
607	*Rebecca 10:16 we've had chipmunks for about 7 years now but these ones only about a year or two*	*student-student*	*Tangential/conversational*
608	*Colin 10:16 wow*	*student-student*	*Tangential/conversational*

'Tangential/ conversational' interaction is closely linked to 'off-topic' conversation (9.1% of interactions in Appendix 10). 'Off-topic' conversation is quite clearly unrelated to the task the students are working on, but possibly also offers the opportunity for students to learn more about one another. The 'tangential/conversation' and 'off-topic' interactions may first appear to be students chatting and wasting time, but this type of interaction could possibly link to building 'Social presence' as discussed in the literature review which is an essential component of collaboration (Beldarrain, 2006; Murphy, 2004; So & Brush, 2008). Providing opportunities for participants to establish trust and share personal

and professional interests is a way to develop social presence (Garrison, 2006). Ubon and Kindle cite social presence as 'a prerequisite to establishing an online community where students can collaborate' (2004, in Beldarrain, 2006 p.149). A level of social presence is especially important at RBAir as students have experienced high levels of social isolation prior to joining RBAir. If the aim is for students to collaborate, then developing a level of social presence, which is fostered through getting to know each other, is important. These types of 'tangential/conversational' and 'off-topic' interactions that allow participants to get to know each other may help to build social presence, which is a key factor in aiding interaction and collaboration.

The 'tangential/conversational' sub-category is the most prevalent interaction in the Mini-centre group (43.7% in Appendix 10), which is the group with the second highest peer-to-peer interaction (70.8 % in Appendix 8). This can possibly be attributed to two different factors, which are highlighted in the excerpt from the Mini-centre group discussion below (Table 4.8). The students are producing a page for the Yearbook which reflects their time at the Mini-centre where they had the opportunity to meet face-to-face with other students in their area for a few hours a week. In the group work they are recalling that they gave each other nicknames, which is a memory, but the content of their conversation is tangential as they start thinking of nicknames for a student who was not at the Mini-centre at that particular time, which they may intend to add to the task they are completing. The conversation is sparked by the activity, but may not directly help them complete the activity.

Table 4.8 Extract from Mini-centre group

Line	***Session 4***	***Interaction Type***	***Interaction code***
270	*Amy 10:56 what was Heathers nickname*	*student-students*	*Tangential/conversational*
271	*Heather 10:57 I didn't have one*	*student-student*	*Tangential/conversational*
272	*I wasn't there*	*student-student*	*Tangential/conversational*
273	*Amy 10:57 oh (emoticon)*	*student-student*	*Tangential/conversational*
274	*Jared 10:57 Make one up now!*	*student-students*	*Tangential/conversational*
275	*Amy 10:57 Heathers name backwards is *******!!*	*student-students*	*Tangential/conversational*
276	*Heather 10:57 really? never heard that one before*	*student-student*	*Tangential/conversational*
277	*Teacher2 10:57 A palindrome*	*teacher-students*	*Tangential/conversational*
278	*Jared 10:57 Call her HH then ??*	*student-student*	*Tangential/conversational*
279	*Teacher210:57 DOuble H*	*teacher-students*	*Tangential/conversational*
280	*Amy 10:58 HH as in helly hansen (emoticon)*	*student-students*	*Tangential/conversational*
281	*Heather 10:58 no way, its a bit late to give me a nickname*	*student-students*	*Tangential/conversational*

The high levels of tangential and off-topic interactions in this group could be attributed to two factors. Firstly, the aim of the activity could increase the likelihood of tangential/conversational interaction, as the objective was to create a memory page of the time and activities at the Mini-centre which involved reminiscing about events which may not have been used in the tasks. Secondly, it is also possible that face-to-face interaction can aid and support peer-to-peer interaction and higher levels of tangential and off-topic interactions as they have built better relationships through a blended programme of online and face-to-face interaction with peers.

The levels of tangential/conversational and off-topic interactions, and the associated benefits, need to be weighed against the effects on group productivity (So & Brush, 2008). Although the levels of conversational/tangential interactions in group work are quite high, it also needs to be considered in context, as the project was not an academic project as such and the students were completing it in the final few weeks of the academic year. It is worth noting that many of these young people are isolated at home, and these tangential off-topic conversations that allow students to get to know each other may be the only social interaction in which they are engaging. Regardless of academic outcomes this peer-to-peer interaction could be viewed as a sign of progress for these young people.

4.2.2 Acknowledgement and Agreement

The second highest interaction sub-category is 'Acknowledge' (12.1% of interactions in Appendix 10*),* defined in Chapter 3 as 'letting others know or confirming you have read/noted their comment'. 'Agreement' is closely linked, and in some cases could overlap with 'Acknowledgement', and indicates that a participant has agreed with the input/statement of another person. This category accounts for 7.8% of interactions being analysed in this section (846 in Appendix 10) and is the fourth highest sub-category.

The high level of 'Agreement' and 'Acknowledge' interaction could possibly be attributed to a number factors. Firstly, in some cases the agreement and acknowledgement are in response to the instructions provided by the teacher. For example, in the Wordle group 33.8% of interactions were to 'Acknowledge' and 18.6% to 'Agree' (Appendix 10). In this instance most of the acknowledgements were in response to teacher instructions and suggestions. The teacher provides instructions on how to create a Wordle, and this highlights the role the teacher plays in group work, and how this shifts the nature of the interactions which occur in small group work.

The high occurrence of agreement and acknowledgement of the input of others may also be linked to the low prevalence of conflict or 'challenging others'. Garrison and Anderson make reference to the

existence of 'pathological politeness' in group work, whereby students will not be 'sceptical or critical of ideas expressed for fear that they might hurt somebody's feelings and damage a relationship' (2003, p.50). Students may be more likely to agree and accept suggestions, ideas or instructions instead of challenging others. Furthermore, this links to a final consideration that the nature of the students may influence the high degree of agreement and acknowledgement.

Table 4.9 Extract from Wordle group

Line	*Session 2*	*Interaction Type*	*Interaction code*
421	*Teacher1 11:35 (emoticon) I like these*	*teacher-student*	*positive praise*
422	*Ok - here's the next step* *If you want a word to come out really big on Wordle, you have to type it the most times.*	*teacher-students*	*Instruction*
423	*Perhaps RBAir should be biggest*	*teacher-students*	*Suggestion*
424	*Sophie 11:35 ok*	*student-teacher*	*Acknowledge*
425	*Maryjane 11:36 ok*	*student-teacher*	*Acknowledge*
426	*Teacher1 11:36 You might like to copy and paste the word, so the spelling is kept good*	*teacher-students*	*Suggestion*
427	*I think about 20 times makes it huge,* *10 times is quite big* *and 5 is fairly big etc*	*teacher-students*	*sharing knowledge*
428	*Maryjane 11:37 ok*	*student-teacher*	*Acknowledge*
429	*Teacher1 11:37 You can always try it out, then redo it, until you like how it looks*	*teacher-students*	*Suggestion*
430	*Maryjane 11:37 ok*	*student-teacher*	*Acknowledge*
431	*Teacher1 11:37 So, if you repeat the words on the doc according to how big you'd like each one.*	*teacher-students*	*Instruction*
432	*You may need to discuss this a bit.*	*teacher-students*	*Suggestion*
433	*Maryjane 11:38 ok*	*student-teacher*	*Acknowledge*
434	*Maryjane 11:41 how we going to start it ??*	*student-group*	*Feedback-seeking*
435	*Teacher1 11:42 I'll show you with RBAir*	*teacher-student*	*Instruction*
436	*Maryjane 11:42 ok*	*student-teacher*	*Acknowledge*
437	*Teacher1 11:43 That will come out quite big on the Wordle now*	*teacher-student*	*Instruction*
438	*Maryjane 11:43 ok*	*student-teacher*	*Acknowledge*

Agreement is high in the Wordle group (18.6%), however this is also the case in the Cover Design group who spend 16.8% of their time agreeing. A notable difference between the groups is that in the Cover Design group this agreement is mainly between students, whilst in the Wordle group this is with the teacher.

4.2.3 Feedback-seeking and feedback-giving

Feedback-seeking and feedback-giving behaviours accounted for 5.2% and 4.7% of all interactions (Appendix 10). Although these are not particularly remarkable percentages, it is worth noting the higher than average levels of feedback-giving (10.7%) and feedback-seeking (11.5%) behaviour in the group. An excerpt from the Cover Design group helps to highlight some moments where students seek and provide feedback as they work together on the for the Yearbook (see Table 4.10).

Table 4.10 Extract from Cover Design group

Line	*Session 2*	*Interaction Type*	*Nature of interaction*
309	*Heather 10:48 That's a good idea! We could put a red balloon in the distance too*	*student-student*	*feedback-giving*
310	*Amy 10:49 yeah*	*student-student*	*agreement*
311	*that one?*	*student-student*	*feedback-seeking*
312	*or your one, either (emoticon)*	*student-student*	*feedback-seeking*
313	*Heather 10:49 Yeah, but smaller*	*student-student*	*feedback-giving*
314	*Amy 10:50 hows that?*	*student-student*	*feedback-seeking*
315	*Heather 10:51 That looks great*	*student-student*	*feedback-giving*
316	*I think that we should change the font on the back*	*student-student*	*Suggestion*
317	*Amy 10:51 Yeah that was just the default one*	*student-student*	*feedback-giving*

4.2.4 Challenging others/ accommodate compromise

Challenging others accounts for only 1.1% of the interactions in this group analysis, and is defined as an interaction where a student has 'disagreed or given an alternative position to that presented by another participant'. A rare example of a situation where a student challenges another student and they come to a compromise is presented in Table 4.11. During the Mini-centre group, one of the students disagrees with putting photographs on the memory page, which has been suggested by another student. Ultimately the students compromise on their differing views and the offending photograph is deleted, however this sub-category (accommodate/compromise) is also particularly low and accounts for only 0.2% of interactions in the smaller groups.

Table 4.11 Extract from Mini-centre group

Line	*Session 3*	*Interaction Type*	*Interaction code*
773	*Heather 11:25 can I delete that one?*	*student-student*	*feedback-seeking*
774	*Amy 11:25 noo!!!*	*student-student*	*feedback-giving*
775	*I look bad in it*	*student-student*	*challenging others*
776	*Im just putting them all*	*student-student*	*challenging others*

777	*Heather 11:25 Please, I can't have pictures of me*	*student-student*	*challenging others*
778	*Amy 11:26 its only everyone at the Mini-centre who has seen you that will see it*	*student-student*	*suggestion*
779	*its only everyone at the Mini-centre who has seen you that will see it*	*student-student*	*elaborate/explain*
780	*Heather 11:27 doesn't matter*	*student-student*	*challenging others*
781	*It's the whole photo thing. I didn't want it done in the first place, Mentor1 forced me*	*student-student*	*elaborate/explain*
782	*Amy 11:27 Okay you can delete it*	*student-student*	*accommodate/compromise*
783	*Heather 11:29Thanks*	*student-student*	*Gratitude*

Challenging others has been discussed in relation to the possibility of the occurrence of 'pathological politeness', which means students avoid challenging others or being critical to avoid damaging relationships. The lack of challenging others and accommodate/compromise behaviour is an indication that although students are interacting, additional work will need to be done for this interaction to amount to effective collaboration, which includes positively challenging others to progress the outcome for the group (Curtis & Lawson, 2001).

4.2.5 Advocating effort

Amidst the low frequency behaviours of challenging others and accommodate/compromise, the sub-category of 'advocating effort' is also particularly low (0.9% in Appendix 10). Despite the low frequency of this behaviour there were some noteworthy occurrences of students seeking the input of peers and seeking to be inclusive. For example, in Table 4.6 (line 487) one student attempts to elicit effort from another, and in Table 4.3. (line 364) Calvin seeks the opinion of Heather who had not shared her opinion on the idea proposed by Amy.

4.2.6 Planning and reflecting/monitoring

The categories of planning and reflection/monitoring are both low accounting for 3.0% and 3.8% of student interactions respectively (Appendix 10). The low levels of this type of interaction may be the result of a number of different factors. Firstly, some of the planning may have taken place in the 'whole group' instant messaging group, and not in the individual smaller groups. However, further analysis of the transcript data suggests that, other than some preparation setting up the smaller groups in Session1, the levels of explicit planning and reflecting are in fact underrepresented in all of the Project transcripts.

Secondly, it is possible that the nature of the activities may not have been sufficiently complex to require much planning or reflecting. Thirdly, the timing of the academic year may have resulted in less reflection as many of the students were graduating within the next few weeks. Furthermore, the final few weeks of the year are not linked to academic outcomes, which may account for why the teachers may have consciously or unconsciously not encouraged reflection. Even so, it is a factor that should be investigated further as planning and reflection are essential components of collaboration in online contexts (Curtis & Lawson, 2001).

Having identified and discussed the nature of the interactions that occurred during the smaller group work activities, these findings will be used to analyse whether or not these interactions constitute any form of collaboration in the next research question.

4.3 Is there evidence of collaboration during the PBL activity in this virtual school for anxious school refusers?

In Research Question 1 it was determined that peer-to-peer interaction occurred during the PBL activity (31.9% of the 2422 interactions), and Research Question 2 established the nature of interactions in the smaller group activities where the highest concentration of peer-to-peer interactions occurred. The third research question addresses whether these interactions show evidence of collaboration (Curtis & Lawson 2001; Murphy 2004).

Murphy (2004) developed a model for collaboration explained in Chapter 2, which is presented as a hierarchy of components needed in order to reach true collaboration (Figure 2.1). An adaptation of Murphy's (2004) collaboration hierarchy has been developed using the collaboration indicators identified by Curtis and Lawson (2001) in Figure 4.3. The illustration depicts the interactions which occurred more frequently at the base of the hierarchy (represented in green), followed by less frequent behaviours that indicate collaborative behaviours towards the top of the hierarchy.

Figure 4.3 Collaboration hierarchy adapted from Murphy (2004) and Curtis and Lawson (2001)

At the base level in Murphy's (2004) model, social presence is essential to facilitate interaction between students in an online environment. The findings from the research discussed in Section 4.2.1 highlight the potential link between tangential/ conversational and off-topic interactions and the cultivation of social presence. Social presence is an essential foundation for collaboration, and if the conversations of this social nature evident in 26.5% of small group interactions (9.1% off topic and 17.4% tangential/conversational in Appendix 10) cultivate social presence, the base level of Murphy's (2004) hierarchy is positively represented. So and Brush vocalise concerns that there may be an 'optimal level of social presence which positively affects collaborative learning', and it possible that 'high levels of connectedness' could have a negative impact on collaboration due to increased levels of 'off-topic conversation and socialising' (2008, p.327-328). Relating this to the cohort of students at RBAir, there is a drive for students to develop friendships and positive interactions with peers due to the high levels of social isolation they may have experienced. However, this needs to be balanced with the possibility that this connectedness and social presence could at times be detrimental to collaborative processes due to high levels of off-topic and tangential conversations. It is however worth noting that this observation in this context may be exaggerated by the timing of this project in the academic year; it was one of the final projects of the year, and it was not linked to any national curriculum outcomes which may have evoked higher levels of socialising activities of an off-topic and tangential nature.

In Murphy's (2004) collaboration hierarchy 'producing of shared artefacts' is presented as the highest form of collaboration. In terms of the Yearbook Project, the students all contributed toward different sections of the production. Although the production was broken down into smaller tasks, which could be seen to represent cooperation (Roschelle & Teasley, 1995), these smaller group activities required students to produce a 'shared artefact' that would be included in the Yearbook. The final production of the Yearbook was collated by RBAir staff members. There may be several underlying reasons for teachers collating the final Yearbook, including time constraints and lack of technical knowhow, however in future this could be reviewed in terms of the overall effect on collaboration and PBL.

Some groups were successful in producing a 'shared artefact', whilst others were unable to complete the tasks within a particular timeframe. The nature of the tasks may have influenced the interactions, including the complexity, difficulty, and student familiarity with this kind of activity. The Cover Design group had a simple task, but one that allowed them to be visually creative. Additional research will need to be conducted into the nature of the tasks that are most effective at promoting collaboration for this cohort of young people.

This PBL activity achieved an insufficient level of 'producing shared artefacts' to constitute collaboration, however there is evidence of some collaborative behaviours represented between the lowest and highest steps in Murphy's (2004) collaboration hierarchy. It is apparent from the findings in this research that some crucial collaborative indicators are underrepresented in the activities such as reflecting and monitoring, advocating effort, challenging and accommodating/ compromising, whilst tangential/conversation and off-topic interactions, which support the cultivation of 'social presence', is more common.

Figure 4.3 does not represent all the collaborative behaviours from Curtis and Lawson's (2001) adapted model, but rather serves as a visual guide for further research and discussion with the staff at RBAir. It may be useful for identifying the behaviours that are less frequently represented but are important collaborative behaviours, as well as interactions that are important but may be over-represented in Project Based Learning activities at RBAir.

4.4 Factors that aid or inhibit peer-to-peer interaction and collaboration in Project Based Learning in a virtual school for anxious school refusers

In the process of addressing the subsidiary research questions a number of factors that contribute toward aiding or inhibiting peer-to-peer interaction and collaboration have already been identified. This section summarises the factors already identified from analysis of the chat transcripts, as well as identifying some additional factors identified from the analysis of the artefacts. Considerable overlap exists between some of the themes, but for simplicity the key findings are discussed under each of the headings below. It is worth noting that this is not an exhaustive list, but provides a foundation for further research, in addition to recommendations and areas for discussion for RBAir to improve practice.

4.4.1 Use of technology

The use of technology emerged as a factor that aids and inhibits peer-to-peer interaction and collaboration during the Yearbook Project. The factors relating to technology were identified through analysis of transcripts, as well as observing the teacher screencasts.

Access issues

In the 2422 lines of chat transcript there were 13 clear incidences of a student/teacher experiencing difficulty with a technical issue (Appendix 12). These issues range from participants communicating issues with permissions, sharing and editing of Google docs and hyperlinks, internet difficulties, and difficulties using third party software. It is not always possible to identify whether these technological barriers to engaging with others, or the activity are due to human error or legitimate external technical difficulties. Either way these technical difficulties can disrupt a participants' ability to engage with others and the task. These access issues are in line with Edelson et al' s (1999) accessibility findings. As much as these technical errors serve as an obstacle in peer-to-peer interaction (when a student cannot connect), in some instances the technical issue presented a problem which students engaged with each other to solve. Table 4.12 provides an example from the Cover Design group whereby two students problem solving a technical issue where one student appeared unable to edit a collaborative document.

Table 4.12 Extract from Cover Design group

Line	*Session 2*	*Interaction Type*
323	*Heather 11:04 For some reason, I can't edit?*	*student-student*
324	*I'm gonna leave and come back in again*	*student-student*
325	*Heather left group chat.*	*n/a*

326	*Heather joined group chat.*	*n/a*
327	*Amy 11:06 is it ok now*	*student-student*
328	*I checked on the settings and it said you could edit it*	*student-student*
329	*Heather 11:06 no, can't edit the first page. I can edit the second*	*student-student*
330	*That shouldn't be an issue though*	*student-student*
331	*Amy 11:07 no.. thats weird*	*student-student*

On the contrary, on other occasions technical difficulties disrupted the momentum of group work and the production of a shared artefact was abandoned. For example, during the Wordle group the students experienced difficulty with the Wordle software plugin, which they were going to use to convert their list of creative words into the final product highlighted in the transcript below (Table 4.13). The technical difficulty meant that the students did not get to complete the task. The role of the teacher and technical issues are addressed in the next section, however it is worth noting here that at times a teacher can be too quick to intervene in peer-to-peer interaction when difficulties (including technical ones) arise, instead of recognising these as an opportunity for students to work together to resolve the issue together.

Table 4.13 Extract from Wordle group

Line	***Chat transcript, Session 3***	***Interaction Type***	***Interaction code***
574	*Teacher2 11:24 Do you want the link to the site to make it and see if you like it*	*teacher-students*	*help giving*
575	*Maryjane 11:24 yh*	*student-teacher*	*Agreement*
576	*Teacher2 11:24 http://www.wordle.net/*	*teacher-students*	*help giving*
577	*Sophie 11:25 ok*	*student-teacher*	*acknowledge*
578	*it wont let me it says pug in is not supported*	*student-teacher*	*reflecting on medium*
579	*Teacher2 11:25 Ok, I'll do it and show you*	*teacher-student*	*help giving*
580	*Sophie 11:26 ok*	*student-teacher*	*acknowledge*
581	*Teacher2 11:26 e too* *Me too*	*teacher-students*	*Agreement*
582	*Sophie 11:26 aw okay*	*student-teacher*	*acknowledge*
583	*Maryjane 11:27 not leting mwe* *me*	*student-teacher*	*feedback-giving*
584	*Teacher2 11:27 I'll have to sort it later*	*teacher-students*	*help giving*

Multiple group participation/ permanency of content

The interactions take place using 'type chat' in group instant messaging, or in some cases using the chat tool available on a collaborative Google document. A participant's typed contribution to a group discussion does not disappear and anyone participating in that group can read the instant message at any

time even if there is a delay in their looking at the 'real time' conversation. Ellis (2001) makes reference to the 'permanency of content' in online contexts, and the advantages of students' not missing conversation as the input is permanently captured in a chat forum. This 'permanency of content' in the RBAir chat forum results in students' simultaneous participation in multiple conversations (increasing peer-to-peer interaction), however further research will be required to understand how this may affect the quality of collaboration.

Collaborative documents

The majority of the students and teachers utilised collaborative Google documents or slides during the PBL activities. These are useful tools for collaboration, and any student can add to the document at any time. A particular example of the usefulness of collaborative documents is highlighted in the incident where Rebecca and Henry had run out of ideas for the Quiz they were creating. Rebecca places a request in the whole group chat group to invite others to contribute ideas, 'me and Henry are a bit stuck so if you have any ideas for the questions it would be really helpful' (Session 2, Line 234), and provides the link to the collaborative document they were working on. A number of students responded to the request and capitalised on the advantages of multiple viewing of the same piece of virtual paper and providing feedback at the same time.

4.4.2 Role of the teacher

The teachers have a demanding, multi-faceted role and the level of skill required to work in a challenging online environment with a vulnerable cohort of young people should be commended. The summary of observations on the role of the teacher is offered to stimulate discussion and reflection from practitioners working in the field.

The occurrence of 'permanency of content' (Ellis, 2001) enabling multiple participation in groups and the resulting multi-tasking extends to the role of the teacher too. When the students break into smaller groups, the teacher has access to the collaborative space/documents the students are working on. Although the teacher may not be watching the student discussions in real time, the teacher can alternate between different groups and see the exact conversations that have taken place. This is different to a face-to-face setting where a record of the conversation between two students does not remain floating in the ether, but rather disappears instantly the moment the words are spoken. The influence of this 'permanency of content' has the potential to alter the teacher's role and the group dynamic for a number of reasons. Firstly, the teacher can quickly assist students when they are experiencing difficulties in their peer-to-peer discussions because they can read what has happened. This is different to physical teaching spaces where the students would have to problem solve and discuss on their own until they could attract

the teacher's attention. Secondly, the students may never feel the level of independence or control to answer questions or to explore with peers because the teacher is 'present' even if not specifically contributing at that moment in the chat forum. The teacher's access to student discussions is convenient on a number of levels, including giving additional feedback and monitoring what has occurred, however teachers need to be aware of how this access could alter their own behaviour and influence the behaviour of the students. Thirdly, this the permanency of content gives teachers the ability to participate in multiple conversations simultaneously. This level of interaction and multi-tasking takes considerable skill, it may have implications for the quality of interactions when the quantity of simultaneous interactions is high.

There appear to be a number of tensions in the teacher's role which may aid or inhibit peer-to-peer interactions at different times. Firstly, there is evidence to suggest that a tension exists between letting students struggle to work out an issue on their own and knowing when to intervene with help or suggestions. In Table 4.9 for example the teacher is very quick to intervene and complete the Wordle task for students, instead of first suggesting the students try to resolve the solution with a few attempts of their own. This may be linked to the second apparent tension, where the teacher needs to be sensitive to the low self-confidence and emotional resilience of this particular cohort of students, while still needing to challenge students to problem solve and encouraging them to work with other students even when they may request to opt out of an activity.

The teacher's role appeared to shift over the course of the four PBL sessions. The teacher initially sets up activities and is highly involved then shifts to supporting the small groups, and in the final session assists with the finalising of the product. Numerous variables influence the teachers' decisions and behaviour at different stages within a project, however some behaviours have a more positive influence on peer-to-peer interaction and collaboration whilst others are less effective. For instance, in Session 4 the teacher resolves a number of challenges for the students instead of encouraging them to work it out in their peer-to-peer interactions as seen in the examples in Table 4.14.

Table 4.14 Examples of Teacher2 interaction in Session 4

Teacher2: Ok, Can you create the doc and send me it now and I'll send it to them ☺ (session4, line 341)
Teacher2: yes I know, don't worry about that I'll organise who needs what ☺ (session4, line 349)
Teacher2: Maryjane and Sophie- I'm working on getting the wordle made, are you happy with the words? (session4, line 45)

It is not possible to tell from the data whether the teacher's behaviour is a result of time constraints, the constraints of the final session, issues with distance and collating the Yearbook, or teacher preference and it will require further investigation. In some cases, the students could have been encouraged to ask each

other directly instead of the teacher acting as the mediator. Teacher1 shows evidence of encouraging students to interact with one another with phrases such as: 'next time you could ask the others if you needed extra ideas?' (Session 1, line 498). Prompting and encouraging student interaction is an important role of the teacher, which could also mean peer interaction is influenced by individual teaching styles and approaches.

In the questionnaire issued prior to the PBL commenced one of the teachers describes the role of the teacher in the upcoming PBL activity as being a 'Social mediator, encourager, someone to broaden possibilities when necessary, a guide for direction of work, resource locator, questioner, encourager, encourager, encourager….'. This perhaps best captures the teacher's recognition of the multi-faceted and challenging role in this context, a role that will require further investigation and discussion after further research.

4.4.3 Nature of students

The nature of this particular cohort of students has an effect on peer-to peer interactions as well as the effectiveness and presence of collaboration. As discussed in Table 2.1, the students attending RBAir have clearly identified social, emotional and academic needs. In some cases, a tension appears to exist between the emotional readiness of a student to engage with peers and the demands of collaborative activities. For example, high degrees of agreement could possibly be indicative of 'pathological politeness' (Garrison & Anderson, 2003). Conflict and resolution of opposing views and working toward a shared level of compromising and understanding are essential components of effective collaboration. However, these behaviours would appear to be a particularly challenging undertaking for these young people who may have a history of unpleasant encounters with peers and seek to avoid this experience altogether. Furthermore, the emotional difficulties these young people are particularly susceptible to were highlighted by the experience of the student who has difficulty engaging with his activity and interacting with peers due to emotional difficulty induced by the topic of the activity.

With a few exceptions the level of peer-to-peer interaction appears to increase with increased time at the virtual school. Most notably as an example, Amy (one of the longest attendees at the virtual school) happily moves between groups to offer help and feedback to different groups the as highlighted in the extract below helping out with the Quiz group (Table 4.15).

Table 4.15 Extract from Session2

Line	*Session 2 transcript*
499	*Amy 11:14 these are good*
500	*Rebecca 11:15 (emoticon) we only need a few more but our minds have gone blank haha*
501	*Amy 11:15 haha umm who is the head of red balloon?*
502	*Rebecca 11:16 what do you mean by head?*

4.4.4 Social presence

In section 4.2.1 the prevalence of tangential/conversational and off-topic interactions were discussed and the possible link to the essential component of social presence was explained. Murphy includes social presence as an essential foundational component in her collaboration hierarchy (2004) and it would seem that establishing a social presence could be an area of strength at RBAir, although further research will be needed to confirm that the high levels of tangential/conversational and off-topic conversations contribute towards high levels of social presence experience by students. Nonetheless, it is worth taking heed of the findings of So and Brush (2008) that optimal levels of social presence are necessary otherwise high levels of socialising may impede the effectiveness and completion of collaborative tasks. Building a community and positive relationships is an essential part of the RBAir programme for students, however it is worth reflecting at which point the positive social and emotional outcomes may influence the effectiveness of collaborative activities.

4.4.5 Project Based Learning

There is a lack of consensus on the exact design principles that constitute PBL, which was highlighted in Chapter 2. A full evaluation of the project design was not the aim of this study, however a number of design elements in this context appear to aid or inhibit peer-to-peer interaction and collaboration. Firstly, the stage of the project influenced the levels of peer-to-peer interaction with Session 1 having less peer-to-peer interaction, whilst sessions dominated by small group work increased peer-to-peer interaction. Secondly, the nature of the task may influence both peer-to-peer interaction as well as levels of collaboration, with collaborative creative tasks requiring more discussion and interaction (as with the Cover Design group). Thirdly, the complexity of the task may also influence levels of interaction with more sophisticated tasks requiring more debate, but creation of simple lists (as in the case of the Wordle group) requiring less interaction as students work alongside each other. Finally, the level of student choice within the project design can influence levels of peer-to-peer interaction especially in cases where students choose to work on an activity that no one else selects, which results in the student working alone.

4.4.6 Time of the year

The Yearbook Project was conducted in the final weeks of the academic year, which may have influenced levels of interaction. By this stage in the academic year students had already participated in groups together for long periods of time which may have facilitated higher levels of peer-peer interaction and influenced levels of social and tangential/conversational interactions. Moreover, due to the timing of the year the activity was not directly linked to the national curriculum or academic credit which may influence the nature as well as the level of interaction.

4.4.7 Whole school scheduling

The participation in the Yearbook Project was at times interrupted by timetabling and logistical issues, which meant that two students had to leave the small group sessions they were working on to attend other sessions (example in Session 1, line 240). The teacher tried her best to find ways to accommodate their absence, but there is no denying that this disrupted the peer-to-peer interaction opportunities.

In addition to this, the project was facilitated by one teacher in the first two sessions and then a second teacher completed the final two sessions. The exact reason for this is not clear (and may relate to a scheduling issue), however it is notable that with the second teacher not being part of planning of the projects in the initial sessions, she tends to treat the remaining sessions as a checklist of activities that need to be completed, with little reflection on the planning and outcomes of the activity.

4.5 Summary of Chapter 4

The factors that may aid or inhibit peer-to-peer interaction and collaboration from each of the sections in Chapter 4 are summarised in Table 4.16

Table 4.16 Summary table of factors that appear to aid or inhibit peer-to-peer interaction and collaboration

	Subcategory	Description	Inhibit/ Aid	Example from data/ sections
Use of technology	Access issues	Technical issues prevent students from interacting or disrupting group work	Inhibits	Barriers to interaction due to tech issues (Section 4.4.1)
			Aids	Peer to peer interaction to problem solve and resolve tech issues (Section 4.4.1 and Table 4.12)
	Permanency of content	Typed contributions to group discussions are permanent and can be read by group members scrolling through the chat transcript at any time.	Aids/ inhibits	Enables multiple participation in conversations/groups increasing peer-to-peer but may inhibit quality of interactions (Section 4.4.1)
			Inhibits	Teacher quick to intervene in small groups as can read conversation of student issues (Section 4.4.2)
	Multiple participation /Multi-tasking	Due to technology (permanency of content, collaborative docs etc.) teacher and student can participate in multiple groups simultaneously	Inhibits	Divided concentration could influence quality of interactions (Section 4.4.1)
			Aids	Could increase amount of interaction due to multiple participation, but compromise quality of interactions (Section 4.4.1)
	Collaborative documents	Google docs were utilised throughout the PBL activities	Aids	Multiple participants can view and edit a document simultaneously on a Google doc (Section 4.4.1)
Role of the teacher	Permanency of content	Teachers have access to student conversations in groups	Inhibit	Teachers can be quick to intervene as can read issues discussed (Section 4.4.2)
	Teacher presence	Permanency of content means multiple participation of the teacher in all groups	Inhibit	Students possibly less empowered as teacher always present, and can intervene in peer-to-peer discussions (Section 4.4.2)
	Multitasking	Due to permanency of content the teacher can participate in several groups and conversations simultaneously	Aid/ Inhibit	Enables teacher to support a number of interactions, but may compromise quality of teacher support (Section 4.4.2)
	Teaching style	Promotion of peer-to peer interaction and collaboration	Aid	When teacher actively promotes interaction with other students (Section 4.4.2)
			Inhibit	When teacher problem solves and completes tasks on students' behalf
	Shifts with project stage	Teachers role evolves at different stages of the project and this influences the level of peer-to-peer interaction	Aid	Promoting small group work during sessions (Section 4.1.1 and 4.1.2)
			Inhibit	Initial setup in session 1 results in less peer-to-peer (Section 4.1.1)
	Social/ Relationship-building	Teacher participates in the tangential/ conversational off-topic discussions with students	Aid	Promoting relationship building and students getting to know each other which builds social presence
			Inhibit	Too much modelling/ promotion of engagement in off-topic & tangential conversations with students could distract from focus on tasks

Nature of students	Emotional well-being	Student emotional state influencing interactions and participation	Inhibit	Student having difficulty engaging with sessions due to emotional state (Section 4.1.3)
	Time at virtual school	On average increased length of time at RBAir increases levels of peer-to-peer interaction	Aid	Section 4.1.3 and Figure 4.2
	Excessive politeness and lack of challenging others	Students displaying low levels of challenging ideas/contributions of others in small group work and compromise which are important collaboration behaviours.	Inhibit	Section 4.2.2 and Section 4.2.4
	Student pairing	Pairing students with more experienced students	Aid	Section 4.1.3
Social presence	Tangential/ Conversational and off-topic	Conversations that could possibly promote the development of social presence	Aids	Establishing social presence is a prerequisite for collaboration (Murphy, 2004)
			Inhibits	Too much social presence could interfere with the effectiveness of the group (So & Brush, 2008)
	Blended/ face-to-face interaction	Inclusion of opportunities for students to meet face-to-face as well as online	Aids	Students working in the Mini-centre group showed much higher peer-to-peer interaction (4.1.2) than other groups and this group had all worked face-to-face
Project Based Learning	Stage of project	The different stages in the project design contain varying levels of peer-to-peer interaction	Aid	Inclusion of small group work (Section 4.1.1 and 4.1.2)
			Inhibit	Teacher-led sessions in earlier sessions (Section 4.1.1 and 4.4.2)
	Nature of the task	May influence both peer-to-peer interaction as well as levels of collaboration	Aid	Collaborative creative tasks requiring more discussion and interaction (as with the Cover Design group)
	Complexity of the activities	Level of challenge and sophistication of the task may promote interactions and debate	Inhibit	Creation of simple lists requiring less interaction as students work alongside each other (as in the case of the Wordle group)
	Student choice	High degrees of student choice during the PBL activity	Aids	Students choosing an activity they are interested in hopefully puts them with other enthusiastic students
			Inhibits	Student choosing an activity to complete which no one else chooses (Section 4.1.3)
Timing of school year	End of year project	The project took place in the final weeks of the year	Aid	Some students had already had the opportunity to work together in groups during the year
	Academic pressure	No links to academic criteria or links to the national curriculum were	Aid/ Inhibit	This may have aided peer-to-peer interactions and levels of off-topic and social/tangential conversations that occurred.
Whole school schedule	Timetable clashes	Students needed to attend other sessions which clash with the PBL activity	Inhibit	Session 1 two students are required to leave half way through to attend a different session
	Teacher scheduling	The team teaching that occurred during the PBL activity	Inhibits	One teacher involved for PBL set up and another for closure may influence effective collaboration.

5 Summary, limitations and recommendations

This chapter provides a summary of the research findings as well as an overview of the limitations of the study. In light of the initial findings of this exploratory research some recommendations for future research are presented, and additional suggestions are raised for the virtual school (RBAir) to consider in order to promote best practice.

5.1 Summary of the study

Research question 1: What type of interaction occurred?

Peer-to-peer interaction accounted for 31.9% (Table 4.1) of interactions during the Yearbook Project, which is encouraging given the weighted importance of peer-to-peer interaction at RBAir. Although this Yearbook Project is only a snapshot of one project at the virtual school, this initial level of analysis of Interaction Types in the chat transcripts per session (Appendix 7), group (Appendix 8) and participant (Appendix 9) has highlighted a number of factors that possibly aid or inhibit peer-to-peer interaction.

These potential factors include the influence of the stage of the project, the importance of small group work, as well as the role of the teacher shifting at different stages in the project which influenced levels of peer-to-peer interaction. Small group work appears to increase peer-to-peer interaction; however, this varies across groups and will be addressed in the next research question. It is likely that on average, length of time at RBAir and familiarity with the context can increase peer-to-peer interaction, however two possible barriers include the emotional state of the student, and level of student choice both of which can inhibit peer-to-peer interaction. Two possible factors which could increase peer-to-peer interaction are the pairing of a new student with students who have been at RBAir for longer periods of time, and complementing online work with blended learning whereby students have the opportunity to meet face-to-face.

Research question 2 and 3: What is the nature of interaction and is there evidence of collaboration?

In this section the nature of the student contributions in the smaller group activities were analysed to gain insight, as higher levels of peer-to-peer interactions happened in these smaller groups. The tangential/conversation and off-topic interactions accounted for some of the highest proportions of the student interactions during the small group work. This could be in part due to the timing of the project in the year, as well as the nature of the project (including complexity, difficulty and student familiarity with the task), and the fact that there were no official academic outcomes associated with the Yearbook

Project. However, the value of relationship building and developing social presence has also been identified as an important factor necessary for effective collaboration. The possibility of face-to-face or blended learning increasing peer-to-peer interactions has also been discussed, and although further research needs to be undertaken, there is a chance that adopting a blended learning approach could have an impact on increased peer to peer interaction, and positive relationship building which would ultimately support more effective collaboration. Although the peer-to-peer interactions in small group work do not amount to a strict definition of collaboration, due to low levels of challenging ideas and accommodating/compromising, there is still evidence of positive feedback and suggestions that with additional support could amount to effective collaboration in the future.

5.2 Limitations of the study

There are several limitations of this study and the results should be interpreted with some level caution but it remains a foundation for further research. First and foremost, this is a particularly niche research area, which lends itself well to the development of an intricate case study but may lack generalisability. Furthermore, the findings of this research are based on one PBL activity, involving ten students and two teachers that was conducted in the final weeks of the academic year. As a consequence, there was no pressure to link the PBL activity to national curriculum outcomes, and a more casual approach to the creation of a Yearbook as the PBL activity may have influenced some of the outcomes.

5.3 Recommendations

Due to the fact that this is one of the first exploratory studies in this niche context, there is limited prior research to which it can be compared. This study has developed some concept clarification in this particular field of technology and education which could be further refined in similar studies. Furthermore, this research study serves as an introduction to the context, and the recommendations for future research are abundant, however as a priority I would recommend:

- Research focusing specifically on the role of the teacher in a virtual school supporting anxious school refusers.
- Longitudinal research tracking students increase in peer-to-peer interaction and collaboration skills from the time they join the virtual centre, as well as ways in which this particular cohort of students can be supported to engage in more challenging collaborative behaviours.
- Additional studies focussing on PBL activities and the inclusion of additional PBL design principles such as linking activities to the national curriculum, including driving questions and providing opportunities for reflection and feedback.

- Research on blended learning opportunities as a vehicle for promoting peer-to-peer interaction and collaboration.
- Research examining social presence in the virtual school context and conditions under which this aids or inhibits collaboration and benefits students academically, socially and emotionally.
- Research to evaluate multiple student groups during PBL and the resulting multi-tasking that occurs and the effects on aiding and inhibiting peer-to-peer interactions and collaboration.
- The collaborative benefits of Google docs showed potential, however additional research on alternative tools, such as digital magazine tools (e.g. [6]Lucid press), could be explored for co-producing the final Yearbook so that the students complete the final product.

In addition to further research opportunities, the organisation may wish to consider the following practical recommendations:

- Teacher workshops: Specifically, to reflect on the role of the teacher within peer-to-peer interaction and collaboration, as well as to share best practice and reflect on chat transcripts to learn from colleagues' strengths.
- Student workshops: Peer-to-peer interaction will not automatically result in collaboration, in addition to reviewing teacher practice, explicit skills workshops may help to develop student collaboration skills which could be built into the curriculum.
- Tracking and supporting student progress: To develop ways of tracking student progress on peer-to-peer interaction and development of collaboration skills which could benefit students emotional, social and academic progress.

5.4 Conclusion

The findings from this exploratory case study should be viewed as a foundation for further research, and as a catalyst for discussion and reflection at RBAir in order to promote best practice. The use of technology in education is receiving significant attention globally, and harnessing best practice through research and reflection will help to ensure the cohort of young people attending this virtual school benefit from continual development and improvement. Supporting these young people back into full time education is a worthy goal, and if the organisation continues to evaluate best practice and undertake further research the students will benefit from the support. Given that anxious school refusal

[6] https://www.lucidpress.com

is a global phenomenon these preliminary findings and further research could help to benefit more than just the students attending the virtual school Red Balloon of the Air in the United Kingdom.

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APPENDIX 1 PARENT CONSENT FORMS

Contact details:
Tel: 01223 366052
lee.royston@rbair.org.uk

26th of May 2014

RE: Consent for project based learning study at 'Red Balloon of the Air'

Dear parent/guardian,

I work at Red Balloon (RB) as the Director of Distance Learning and am also currently working toward an MPhil at the University of Cape Town in 'Information Communication Technology and Education'. As part of my final research dissertation I am carrying out a study on 'project based learning in virtual schools' using the 'Red Balloon of the Air' context. The RB teaching staff have arranged a series of project based learning opportunities for students and your child will have the opportunity to participate. The projects will be run after exams by the teaching team during normal school hours.

The purpose of the study is to investigate the implementation of project based learning in a virtual school. Please can you indicate below if you give consent for your child to participate in the activities (yearbook project & Christmas card project) and to complete a short reflective questionnaire at the end of it. All information gathered for the study will be anonymised and no names will be used in the final write up.

If you have any questions, please don't hesitate to contact me at the office on 01223 354 338 or lee.royston@rbair.org.uk

The projects are due to start on the 11th of June 2015, please can you return the form by this date to allow your child to participate. The form can be returned in the self-addressed envelope provided or via email.

Many thanks,

Lee Royston
(Director of Distance Learning at Red Balloon, and MPhil student at the University of Cape Town)

Authorisation

If you have decided that your child can participate in this study, please sign this form in the space provided below as an indication that you have read and understood the information provided above.

---------- ----------

Name of child participating (please print) Date

---------- ----------

Name of parent (please print) Signature of parent

APPENDIX 2 TEACHER CONSENT FORM

Tel: 01223 366052
lee.royston@rbair.org.uk

26th of May 2014

RE: Consent for project based learning at 'Red Balloon of the Air'

Dear (insert teachers name),

I am working toward an MPhil at the University of Cape Town in 'ICT and Education'. As part of my final research dissertation I am carrying out a study on 'project based learning in virtual schools' with RBAir as the site of study. I would like to invite you to participate by responding to a questionnaire and two semi-structured interviews on the project based learning experience you are facilitating for students in the summer term. It has been negotiated with your manager that your participation time will form part of your normal working hours wherever possible. All data collected will be kept confidential and information used will be anonymised in the final report. A draft of the report will be available for your comments before it is submitted.

The purpose of the study is to investigate the implementation of project based learning in a virtual school for the cohort of students who attend RBAir. The research is likely to be of interest to other practitioners from virtual schools and researchers examining alternative teaching and learning strategies in virtual school contexts.

Your participation and contribution will be gratefully appreciated. Please indicate your willingness to participate by completing the section below.

Kind regards,

Lee Royston

Authorisation

If you have decided to participate in this study, please sign this form in the space provided below as an indication that you have read and understood the information provided above and have agreed to participate.

---------- ----------

Name of Research Participant (please print) Date

Signature of Research Participant

APPENDIX 3 STUDENT CONSENT FORM

Contact Lee Royston

01223 366052

lee.royston@rbair.org.uk

26th of May 2014

RE: Consent for project based learning at 'Red Balloon of the Air'

Dear Students,

I work for Red Balloon of the Air, and am also currently a student working towards a Masters in Education and ICT (information communication technology) from the University of Cape Town.

I am researching 'project based learning' in virtual schools like Red Balloon of the Air and some projects in which you have showed interest for the summer term (the yearbook project and the Christmas card project) will be used in the study. Both these projects will occur during normal school time and will involve you attending some online sessions and completing a short reflection form at the end of the project. None of your names will be used in the final report and write up!

I have sent information about this research study and a consent form to your guardian/parent to complete in order for you to participate in the projects. If you have any questions about the projects or my research please let me (lee.royston@rbair.org.uk) or Christine.perkins@rbair.org.uk know and we can answer any questions or concerns before we start.

Many thanks,

Lee Royston

Director of Distance Learning at Red Balloon, and research student at the University of Cape Town

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Please type your name and the date to say you are okay with the information above...

1. eg. Joe Soap (11/06/2015)
2.
3.

APPENDIX 4 TEACHER QUESTIONNAIRE

Teacher questionnaire

Please could you complete the following questionnaire prior to the projects starting on the 15th of June.

1. What do you perceive to be the pros of Project Based Learning (PBL) at Red Balloon (RB)?
2. What do you perceive to be the cons of PBL at RB?
3. What may influence how students engage with one another within a shared project?
4. What may influence how students work together toward a shared goal/project?
5. What would effective collaboration/working together look like in a PBL session at RB?
6. What do you think the role of the teacher is in facilitating students engaging with and working together on a project?
7. What challenges do you think you may encounter in the upcoming summer PBL project you are running?
8. Any additional questions comments/ thoughts to share at this stage? Or are there any questions you would like to answer that I haven't asked?

Thank you for completing the questionnaire

APPENDIX 5 STUDENT QUESTIONNAIRE

</forms/d/1eW5cX-uY2RcnBfocrLNubOpPku3JbHE30QolpVZjQ8U/viewform

Journal of Child Psy

Yearbook questionnaire

Hi, please can you take a few minutes to answer some questions about your participation in the yearbook project. Your answers will be kept anonymous. Thanks for your time!

Your username (lee.royston@rbair.org.uk) will be recorded when you submit this form. Not lee.royston? Sign out
*Required

How much did you enjoy participating in the yearbook project? *

	1	2	3	4	5	6	7	8	9	10	
I didn't enjoy it at all	○	○	○	○	○	○	○	○	○	○	I really enjoyed it

Can you describe THREE things you liked/enjoyed most about participating in the yearbook project *

Was there anything about the yearbook project that you did NOT like/enjoy? *

How much did you enjoy working with the other students on the yearbook project? *

	1	2	3	4	5	6	7	8	9	10	
I did not enjoy working with other students	○	○	○	○	○	○	○	○	○	○	I really liked working with other students

How difficult did you find working with the other students on this project? *

	1	2	3	4	5	6	7	8	9	10	
I found it very challenging	○	○	○	○	○	○	○	○	○	○	It was not challenging at all

How difficult did you find working with the other students on this project? *

	1	2	3	4	5	6	7	8	9	10	
I found it very challenging	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	It was not challenging at all

Can you describe THREE things that can be positive about working with other students on projects at RBAir? *

Can you describe THREE things that can be difficult/challenging working with other students on projects at RBAir? *

What role do you think the teacher should play during a project like the yearbook project? *

Do you have any ideas of how we could change or improve the way the year book project is run next year? *

☐ Send me a copy of my responses.

Submit

Never submit passwords through Google Forms.

APPENDIX 6 **EXAMPLE CHAT TRANSCRIPT FROM SESSION 1**

Line	Chat transcript	Person	Group	Interaction Type	Nature of Interaction
360	**Cover design**	n/a	n/a	n/a	
361	Me: Hello - you can use this text box to start planning out the cover together. ☺	Teacher1	cover design	teacher-students	Initiating activity
362	Amy • 32 mins I think use slides because its easier to move stuff on there than on a word doc	Amy	cover design	student-students	Sharing knowledge
363	Calvin • 32 mins ok den	Calvin	cover design	student-student	Agreement
364	Calvin • 32 mins yeh that might make sense, what about u Heather?	Calvin	cover design	student-student	Advocating effort
365	Heather • 31 mins Yeah, I think that's a good idea	Heather	cover design	student-student	Agreement
366	Calvin • 31 mins shall i make the doc then?	Calvin	cover design	student-students	Initiating activity
367	Amy • 31 mins Yeah okay	Amy	cover design	student-student	Agreement
368	(*inserts link to google presentation template)	Calvin	cover design	student-student	Initiating activity
369	Calvin • 29 mins Heather it wont let me share it with you	Calvin	cover design	student-student	Help seeking
370	Amy • 28 mins Thank you!	Amy	cover design	student-student	Gratitude
371	Amy • 28 mins do you want me to	Amy	cover design	student-student	help giving
372	I'll share it with her	Amy	cover design	student-student	help giving
373	Heather • 28 mins Thanks	Heather	cover design	student-student	Gratitude
374	Calvin • 28 mins yeh if you can	Calvin	cover design	student-student	Agreement
375	Amy • 28 mins Heather you should be ok to get onto it now	Amy	cover design	student-student	Help giving
376	Heather • 27 mins Thanks	Heather	cover design	student-student	Gratitude
377	**Cover Design conversation on Google doc**	n/a	n/a	n/a	
378	(Possibly a few line of chat missing as teacher opened the doc after students had started)	n/a	n/a	n/a	
379	Calvin 11:41 btw you can delete the stuff im doing if it look rubbish, its just me testing	Calvin	cover design	student-students	Advocating effort
380	Amy 11:41 ive done it but it keeps the edging around it :/	Amy	cover design	student-students	Help seeking
381	Me 11:44 One slight problem that I can see...	Teacher1	cover design	teacher-students	Challenging others
382	Heather 11:44 Can we experiment with different fonts?	Heather	cover design	student-students	Feedback seeking
383	Me 11:44 I think the Yearbook will be portrait..	Teacher1	cover design	teacher-students	elaborate/explain
384	Calvin 11:44 Yeh im just messing about	Calvin	cover design	student-student	Agreement
385	Amy 11:44 oh nooo	Amy	cover design	student-students	Acknowledge
386	Calvin 11:44 oh nooo	Calvin	cover design	student-students	Acknowledge
387	Heather 11:44 uh oh	Heather	cover design	student-students	Acknowledge
388	Amy 11:45 do slides not go portrait	Amy	cover design	student-students	Suggestion
389	Me 11:45 They can!	Teacher1	cover design	teacher-student	Agreement
390	File - page setup and choose in there.	Teacher1	cover design	teacher-student	help giving
391	Calvin 11:45 hahaahahaa	Calvin	cover design	student-students	Acknowledge
392	Amy 11:46 oh dear	Amy	cover design	student-students	Acknowledge
393	Calvin 11:46 hahahaha	Calvin	cover design	student-students	Acknowledge
394	Amy 11:46 well..	Amy	cover design	student-students	Acknowledge
395	Heather 11:46 I think we may need to start again	Heather	cover design	student-students	Suggestion
396	Calvin 11:46 oh well why is it so slim?	Calvin	cover design	student-students	Feedback seeking
397	Heather 11:48 I have found another sky background that is portrait	Heather	cover design	student-students	Suggestion
398	Calvin 11:49 why is it so slim though	Calvin	cover design	student-students	Feedback seeking
399	Amy 11:49 make it wider. if you go on page set up where it says 7 make it hugher	Amy	cover design	student-student	Feedback giving
400	Calvin 11:50 that look better	Calvin	cover design	student-students	Feedback giving
401	Amy 11:52 yeah	Amy	cover design	student-student	Agreement
402	why is it black :/	Amy	cover design	student-students	Feedback seeking
403	it would be good if the black wasnt there	Amy	cover design	student-students	Feedback giving
404	Heather 11:55 I found a hot air balloon that looks like a strawberry!!!	Heather	cover design	student-students	tangential
405	Amy 11:55 haha what?	Amy	cover design	student-student	tangential
406	Heather 11:56 let me show you	Heather	cover design	student-student	tangential
407	How cool is that? I'll get rid of it now	Heather	cover design	student-student	tangential

408	Amy 11:56 hahah it even has green at the top for the leaves, imagine actually seeing it	Amy	cover design	student-student	tangential
409	Heather 11:57 That would be so cool!	Heather	cover design	student-student	tangential
410	You would think you were going mad though	Heather	cover design	student-student	tangential
411	Amy 11:57 how does that hot air balloon look?	Amy	cover design	student-student	Feedback seeking
412	haha yeah	Amy	cover design	student-student	tangential
413	Heather 11:57 It looks really good, I like the stripes	Heather	cover design	student-student	Feedback giving
414	Amy 11:57 yeah Thanks	Amy	cover design	student-student	gratitude
415	Should we just put it at RBair 2015 yearbook because its going to be a yearbook nto just a project	Amy	cover design	student-student	Suggestion
416	Heather 11:58 Yeah	Heather	cover design	student-student	Agreement
417	Amy 11:59 mabe see how the writing looks red?	Amy	cover design	student-student	Suggestion
418	Heather 11:59 Good idea	Heather	cover design	student-student	Agreement
419	Amy 11:59 because its a bit dark to see	Amy	cover design	student-student	elaborate/explain
420	Heather 12:00 Yeah :0	Heather	cover design	student-student	agreement
421	That looks really good	Heather	cover design	student-student	Feedback giving
422	Amy 12:01we can see maybe if we should add anything else next time when Calvin is here	Amy	cover design	student-student	suggestion
423	Heather 12:01 Yeah, he may have some good ideas too	Heather	cover design	student-student	agreement
424	Me : Just to help:	Amy	cover design	student-student	agreement
425	See you in circle time at 3	Amy	cover design	student-student	social-offtopic
426	Heather 12:02 See you then, bye	Heather	cover design	student-student	Greeting/goodbye
427	Amy 12:02 bye!	Amy	cover design	student-student	Greeting/goodbye
428	Amy left group chat.	n/a	n/a	n/a	
429	Heather left group chat.	n/a	n/a	n/a	
430	**Quiz group**	n/a	n/a	n/a	
431	Me 30 mins Hi Henry and Rebecca	Teacher1	quiz	teacher-students	greeting/goodbye
432	You can use this text box to share ideas - start a doc, think about what to put in the quiz together, etc.	Teacher1	quiz	teacher-students	initiating activity
433	Rebecca • 29 mins hi 💁	Rebecca	quiz	student-teacher	greeting/goodbye
434	Henry • 29 mins hii	Henry	quiz	student-teacher	greeting/goodbye
435	Rebecca • 27 mins do you want to start up a doc or stay here?	Rebecca	quiz	student-student	organizing work
436	Henry • 27 mins Up to you :L	Henry	quiz	student-student	feedback giving
437	Me 27 mins You might like a doc, as you can record all the questions on there in a format we can use easily?	Teacher1	quiz	teacher-students	suggestion
438	okay ☺	Teacher1	quiz	teacher-student	acknowledge
439	Rebecca • 25 mins Teacher1 can you invite Henry to the doc because I can't ☹	Rebecca	quiz	student-teacher	help seeking
440	Me 25mins Will do ☺	Teacher1	quiz	teacher-student	agreement
441	Rebecca • 25 mins Thanks	Rebecca	quiz	student-teacher	gratitude
442	(*student inserts link to Google doc)	Rebecca	quiz	student-teacher	organizing work
443	Me 24mins : ☺ done	Teacher1	quiz	teacher-student	organizing work
444	Rebecca 24 mins 😀	Rebecca	quiz	student-teacher	acknowledge
445	Me : Just to help: It will have to be a quiz with proper answers	Teacher1	quiz	teacher-students	help giving
446	So, things like, who's the tallest member of staff?	Teacher1	quiz	teacher-students	elaborate/explain
447	RBAir is based in a windmill, true or false?	Teacher1	quiz	teacher-students	elaborate/explain
448	HOpe that gives you some ideas	Teacher1	quiz	teacher-students	help giving
449	Group B On doc chat Henry and Rebecca:	n/a	n/a	n/a	
450	Henry joined group chat.	n/a	n/a	n/a	
451	Henry 11:35 This is harder than it sounds	Henry	quiz	student-student	feedback giving
452	Rebecca 11:36 yeah haha	Rebecca	quiz	student-student	agreement
453	Me 11:39 I can help out with the answers, if you think up questions	Teacher1	quiz	teacher-students	help giving
454	Rebecca 11:46 cant think of anymore	Rebecca	quiz	student-student	feedback giving
455	Me 11:47 lol, Henry, as if we could!!	Teacher1	quiz	teacher-student	feedback giving
456	Henry 11:47 :L	Henry	quiz	student-teacher	acknowledge
457	Rebecca left group chat.	n/a	n/a	n/a	
458	Henry left group chat.	n/a	n/a	n/a	
459	**Wordle group**	n/a	n/a	n/a	

460	Me 35mins Hiya - you can start to plan ideas in this text box	Teacher1	Wordle	teacher-students	initiating activity
461	One of you will need to open and share a new doc to collect the Wordle words	Teacher1	Wordle	teacher-students	initiating activity
462	Sophie • 34 mins um whos going to open the doc just so we dont have 2 😛	Sophie	Wordle	student-group	organizing work
463	Maryjane • 33 mins ☺	Maryjane	Wordle	student-teacher	acknowledge
464	Me: 31mins Sophie - you want to get the doc going? 31 mins	Teacher1	Wordle	teacher-student	advocating effort
465	Sophie • 30 mins okay is it just a normal google doc	Sophie	Wordle	student-teacher	clarification seeking
466	Me 29mins Yes that would be good.	Teacher1	Wordle	teacher-student	agreement
467	Wordle works like this: First you collect lots of words about a topic. If you want a word to appear bigger, you type it in more times. The fewer times a word appears in the list, the smaller it is.	Teacher1	Wordle	teacher-student	sharing knowledge
468	So you will need to collect words about RBAir together ☺	Teacher1	Wordle	teacher-student	suggestion
469	Sophie • 29 mins um so im confused are we planning what words we want on a google doc then putting them into Wordle	Sophie	Wordle	student-teacher	clarification seeking
470	Me 27mins Yes - the doc will be your word list.	Teacher1	Wordle	teacher-student	elaborate/explain
471	Sophie • 27 mins it wont let me share the doc	Sophie	Wordle	student-teacher	reflecting on medium
472	Me 27mins -Share with me and I can share with Maryjane too. ☺	Teacher1	Wordle	teacher-student	reflecting on medium
473	Sophie • 27 mins okay thank you	Sophie	Wordle	student-teacher	gratitude
474	Group C Doc chat, Sophie and Maryjane:	n/a	n/a	n/a	
475	Maryjane joined group chat.	n/a	n/a	n/a	
476	Maryjane 11:35 hi	Maryjane	Wordle	student-student	greeting/goodbye
477	Sophie 11:36 hey	Sophie	Wordle	student-student	greeting/goodbye
478	Maryjane 11:36 u ok	Maryjane	Wordle	student-student	greeting/goodbye
479	Sophie 11:36 yeah im good im not sure what words to do though	Sophie	Wordle	student-student	unsure/confusion
480	Maryjane 11:36 yh same	Maryjane	Wordle	student-student	agreement
481	Sophie 11:38 um okay so if its stuff to do with rbair um we could have the name of soem lessons we have done maybe	Sophie	Wordle	student-student	suggestion
482	Me 11:38 That's a good idea	Teacher1	Wordle	teacher-student	positive praise
483	Also, words from wellbeing, and the kinds of things we like to encourage, like kindness, caring etc?	Teacher1	Wordle	teacher-student	suggestion
484	Sophie 11:39 yeah	Sophie	Wordle	student-teacher	agreement
485	Maryjane 11:40 ok	Maryjane	Wordle	student-teacher	acknowledge
486	Sophie 11:45 what else do you think we could have ?	Sophie	Wordle	student-student	advocating effort
487	Maryjane 11:45 teachers	Maryjane	Wordle	student-student	suggestion
488	Sophie 11:46 ok	Sophie	Wordle	student-student	agreement
489	Maryjane 11:47 (emoticon)	Maryjane	Wordle	student-student	acknowledge
490	Sophie 11:47 so like names of teachers ?	Sophie	Wordle	student-student	clarification seeking
491	Maryjane 11:47 yh	Maryjane	Wordle	student-student	agreement
492	Sophie 11:47 ok cool	Sophie	Wordle	student-student	acknowledge
493	Maryjane 11:47 (emoticon)	Maryjane	Wordle	student-student	acknowledge
494	Sophie 11:48 you might of had some diffrent teachers to me	Sophie	Wordle	student-student	elaborate/explain
495	Maryjane 11:48 yh i hade them had	Maryjane	Wordle	student-student	elaborate/explain
496	Sophie 11:48 (emoticon)	Sophie	Wordle	student-student	acknowledge
497	Maryjane 11:48 (emoticon)	Maryjane	Wordle	student-student	acknowledge
498	Me 11:49 Next time you could ask the others if you needed extra ideas?	Teacher1	Wordle	teacher-students	suggestion
499	Sophie 11:49 ok	Sophie	Wordle	student-teacher	agreement

APPENDIX 7 TABLE OF ANALYSIS OF TRANSCRIPT DATA PER SESSION

		Totals		No. Interaction Types per Session							
				Session1		Session2		Session3		Session4	
Interaction Type		No. interactions	% total contribution for sessions	No. interactions	% total	No. interactions	% total	No. interactions	% total	No. interactions	% total
student-student		641	26.5%	86	17.1%	192	32.4%	296	32.6%	67	16.0%
student-students		132	5.5%	22	4.4%	6	1.0%	56	6.2%	48	11.5%
student-group		256	10.6%	100	19.9%	55	9.3%	72	7.9%	29	6.9%
student-teacher		591	24.4%	91	18.1%	138	23.3%	234	25.8%	128	30.5%
teacher-group		177	7.3%	96	19.1%	49	8.3%	19	2.1%	13	3.1%
teacher-students		126	5.2%	22	4.4%	47	7.9%	41	4.5%	16	3.8%
teacher-student		499	20.6%	86	17.1%	106	17.9%	189	20.8%	118	28.2%
Total contributions		2422	100.0%	503	100.0%	593	100.0%	907	100.0%	419	100.0%
Peer-to-peer	student-student & student-students	773	31.9%	108	21.5%	198	33.4%	352	38.8%	115	27.4%
Student voice	student-student & student-students & student-group	1029	42.5%	208	41.4%	253	42.7%	424	46.7%	144	34.4%
Teacher voice	teacher-group & teacher-students	303	12.5%	118	23.5%	96	16.2%	60	6.6%	29	6.9%
One-to-one student & teacher	Teacher-student & student-teacher	1090	45.0%	177	35.2%	244	41.1%	423	46.6%	246	58.7%

APPENDIX 8 TABLE OF ANALYSIS OF CHAT TRANSCRIPT DATA PER GROUP

			Sub-groups																			
Interaction Types	*TOTAL*		*Cover Design*		*Quiz*		*Wordle*		*Quotes*		*Playlist*		*Mini-centre*		*Whole group (session1)*		*Whole group (session2)*		*Whole group (session3)*		*Whole group (session4)*		*One-to-one*	
	No	*%*	*no*	*%*	*no*	*%*	*no*	*%*	*no*	*%*	*no*	*%*	*no*	*%*	*no*	*%*	*no*	*%*	*no*	*%*	*no*	*%*	*no*	*%*
student-student	641	26.5%	93	57.8%	52	33.1%	56	24.0%	0	0.0%	148	44.0%	123	45.7%	22	6.2%	50	19.5%	91	35.5%	6	10.0%	0	0.0%
student-students	132	5.5%	21	13.0%	1	0.6%	0	0.0%	0	0.0%	20	6.0%	48	17.8%	1	0.3%	6	2.3%	35	13.7%	0	0.0%	0	0.0%
student-group	256	10.6%	0	0.0%	1	0.6%	6	2.6%	0	0.0%	21	6.3%	6	2.2%	99	27.8%	53	20.7%	45	17.6%	25	41.7%	0	0.0%
student-teacher	591	24.4%	17	10.6%	40	25.5%	83	35.6%	24	43.6%	81	24.1%	29	10.8%	67	18.8%	60	23.4%	35	13.7%	8	13.3%	147	51.9%
teacher-group	177	7.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	96	27.0%	49	19.1%	19	7.4%	13	21.7%	0	0.0%
teacher-students	126	5.2%	16	9.9%	18	11.5%	38	16.3%	0	0.0%	7	2.1%	26	9.7%	7	2.0%	9	3.5%	4	1.6%	1	1.7%	0	0.0%
teacher-student	499	20.6%	14	8.7%	45	28.7%	50	21.5%	31	56.4%	59	17.6%	37	13.8%	64	18.0%	29	11.3%	27	10.5%	7	11.7%	136	48.1%
TOTALS	2422	100%	161	100%	157	100%	233	100%	55	100%	336	100%	269	100%	356	100%	256	100%	256	100%	60	100%	283	100%
Peer-to-peer	773	31.9%	114	70.8%	53	33.8%	56	24.0%	0	0.0%	168	50.0%	171	63.6%	23	6.5%	56	21.9%	126	49.2%	6	10.0%	0	0.0%
student-voice	1029	42.5%	114	70.8%	54	34.4%	62	26.6%	0	0.0%	189	56.3%	177	65.8%	122	34.3%	109	42.6%	171	66.8%	31	51.7%	0	0.0%
teacher-voice	303	12.5%	16	9.9%	18	11.5%	38	16.3%	0	0.0%	7	2.1%	26	9.7%	103	28.9%	58	22.7%	23	9.0%	14	23.3%	0	0.0%
One-to-one teacher and student	1090	45.0%	31	19.3%	85	54.1%	133	57.1%	55	100%	140	41.7%	66	24.5%	131	36.8%	89	34.8%	62	24.2%	15	25.0%	283	100.0%

APPENDIX 9 TABLE OF ANALYSIS OF CHAT TRANSCRIPT PER PARTICIPANT

	TOTAL		Amy		Calvin		Colin		Heather		Henry		Jared		Joanna		Maryjane		Rebecca		Sophie		Teacher1		Teacher2	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No	%	No.	%	No.	%
student-student	**641**	**26.5%**	158	48.2%	39	31.5%	139	43.8%	88	66.2%	17	18.7%	72	48.3%	5	7.8%	32	24.2%	51	35.9%	40	28.6%				
student-students	**132**	**5.5%**	40	12.2%	21	16.9%	23	7.3%	15	11.3%	0	0.0%	19	12.8%	3	4.7%	0	0.0%	5	3.5%	6	4.3%				
student-group	**256**	**10.6%**	41	12.5%	29	23.4%	48	15.1%	12	9.0%	6	6.6%	37	24.8%	13	20.3%	19	14.4%	23	16.2%	28	20.0%				
student-teacher	**591**	**24.4%**	89	27.1%	35	28.2%	107	33.8%	18	13.5%	68	74.7%	21	14.1%	43	67.2%	81	61.4%	63	44.4%	66	47.1%				
teacher-group	**177**	**7.3%**	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	145	35.7%	32	8.1%
teacher-students	**126**	**5.2%**	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	69	17.0%	57	14.4%
teacher-student	**499**	**20.6%**	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	192	47.3%	307	77.5%
TOTAL	**2,422**	**100%**	**328**	**100%**	**124**	**100%**	**317**	**100%**	**133**	**100%**	**91**	**100%**	**149**	**100%**	**132**	**100%**	**142**	**100%**	**140**	**100%**	**140**	**100%**	**406**	**100%**	**396**	**100%**
Peer to Peer	773	31.9%	198	60.4%	60	48.4%	162	51.1%	103	77.4%	17	18.7%	91	61.1%	32	24.2%	56	39.4%	46	32.9%						
Student voice	1029	42.5%	239	72.9%	89	71.8%	210	66.2%	115	86.5%	23	25.3%	110	73.8%	51	38.6%	79	55.6%	74	52.9%						
Teacher voice	802	33.1%																					396		499	
One-to-one teacher and student	1090	45.0%	89	27.1%	35	28.2%	107	33.8%	18	13.5%	68	74.7%	21	14.1%	43	67.2%	81	61.4%	63	44.4%	66	47.1%	192	47.3%	307	77.5%

APPENDIX 10 SUMMARY OF NATURE OF INTERACTIONS IN SMALL GROUP ACTIVITIES

		Summary of student contributions in groups												Category totals	
		Cover design		Wordle		Quiz		Minicentre		Playlist		Sub-category total	% of total interaction	Category total	Overarching % of total
Category	Sub-category	no.	%	no.	%	no.	%	no.	%	no.	%				
Planning	Organizing work	3	2.3%	2	1.4%	8	8.5%	1	0.5%	3	1.1%	17	2.0%	25	3.0%
	Initiating activity	5	3.8%	0	0.0%	0	0.0%	0	0.0%	3	1.1%	8	0.9%		
Contributing	help giving	7	5.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	7	0.8%	356	42.1%
	feedback-giving	14	10.7%	5	3.4%	7	7.4%	5	2.4%	9	3.3%	40	4.7%		
	exchanging resources	2	1.5%	0	0.0%	0	0.0%	2	1.0%	2	0.7%	6	0.7%		
	Suggestion	12	9.2%	9	6.2%	6	6.4%	7	3.4%	7	2.6%	41	4.8%		
	Instruction	0	0.0%	0	0.0%	0	0.0%	0	0.0%	5	1.9%	5	0.6%		
	sharing knowledge	1	0.8%	2	1.4%	0	0.0%	2	1.0%	22	8.1%	27	3.2%		
	challenging others	0	0.0%	1	0.7%	0	0.0%	5	2.4%	3	1.1%	9	1.1%		
	Agreement	22	16.8%	27	18.6%	3	3.2%	4	1.9%	10	3.7%	66	7.8%		
	Acknowledge	12	9.2%	49	33.8%	7	7.4%	11	5.3%	23	8.5%	102	12.1%		
	elaborate/explain	2	1.5%	4	2.8%	2	2.1%	5	2.4%	38	14.1%	51	6.0%		
	accommodate/ compromise	0	0.0%	1	0.7%	0	0.0%	1	0.5%	0	0.0%	2	0.2%		
Seeking input	Help seeking	9	6.9%	1	0.7%	4	4.3%	0	0.0%	5	1.9%	19	2.2%	99	11.7%
	Feedback-seeking	15	11.5%	12	8.3%	4	4.3%	2	1.0%	11	4.1%	44	5.2%		
	clarification seeking	4	3.1%	7	4.8%	4	4.3%	3	1.5%	10	3.7%	28	3.3%		
	Advocating effort	2	1.5%	1	0.7%	2	2.1%	2	1.0%	1	0.4%	8	0.9%		
Reflection/ monitoring	Monitoring group effort	0	0.0%	1	0.7%	2	2.1%	1	0.5%	14	5.2%	18	2.1%	32	3.8%
	Reflecting on medium	0	0.0%	2	1.4%	2	2.1%	2	1.0%	8	3.0%	14	1.7%		
Social/ relationship building	Gratitude	6	4.6%	2	1.4%	7	7.4%	1	0.5%	8	3.0%	24	2.8%	334	39.5%
	Tangential/ conversational	8	6.1%	0	0.0%	25	26.6%	90	43.7%	24	8.9%	147	17.4%		
	greeting/goodbye	2	1.5%	11	7.6%	2	2.1%	3	1.5%	11	4.1%	29	3.4%		
	social-off topic	1	0.8%	0	0.0%	0	0.0%	44	21.4%	32	11.9%	77	9.1%		
	unsure/confusion	4	3.1%	8	5.5%	0	0.0%	0	0.0%	4	1.5%	16	1.9%		
	Humour	0	0.0%	0	0.0%	7	7.4%	11	5.3%	9	3.3%	27	3.2%		
	positive praise	0	0.0%	0	0.0%	2	2.1%	4	1.9%	8	3.0%	14	1.7%		
TOTAL		131	100.0%	145	100.0%	94	100.0%	206	100.0%	270	100.0%	846	100.0%	846	100.0%

APPENDIX 11 EXPLANATION OF HOW DATA WAS ANALYSED

This section gives a brief explanation of how the tables in Appendix 7, Appendix 8, Appendix 9 and Appendix 10 were calculated.

Appendix 7 – The table shows an analysis of Interaction Types per session. The total number of interactions for each session ranges from 503 in Session 1, to 593 for Session 2, to 907 for Session 3 and 414 in Session 4. The table also illustrates the concentration of Interaction Types per session presented as a percentage, which is calculated by dividing the number of interactions in each Interaction Type for the session, by the total number of interactions for that session (e.g. the concentration of student-student interactions in Session 1 is calculated as 86 student-student interactions /503 interactions in Session 1 = 17.1%). This has been calculated in order to identify the varying concentrations of Interaction Types for the different sessions, regardless of the overall number of interactions that took place during the session.

Appendix 8 – The table shows an analysis of Interaction Types per smaller group activity. The table shows the total number of interactions that occurred for each activity, as well as the total number of interactions for each Interaction Types during each activity. In addition to this, for each group the frequency of different Interaction Types is calculated by dividing the number of interactions of each Interaction Type for the group, by the total number of interactions for that group (e.g.: student-student= 93 interactions /161 interactions in Cover Design group = 57.8%)

Appendix 9 – The table shows an analysis of the Interaction Types per participant in the Yearbook activity. The table shows the total number of interactions for each participant, and the number of Interaction Types per participant. In addition to this, the frequency of each Interaction Type for each participant is calculated by dividing the number of interactions per Interaction Type, by the total number of interactions for each participant.

Appendix 10 – This table shows an analysis of the nature of interactions that occurred during each of the small group activities which were further analysed due to the higher frequency of peer-to-peer interaction that took place during the smaller group work activities. A total number of interactions for each category and sub-category is provided for each group. In addition to this the frequency of a particular sub-category within each group was calculated by dividing the number of sub-category interactions by the total number of interactions for that group (eg: for the Help-giving subcategory= 7 help-giving interactions in the group/ 131 total interactions in the group = 5.3% of all interaction in the Cover design group.

APPENDIX 12 SUMMARY OF TECHNICAL ISSUES REPORTED IN CHAT TRANCRIPTS

Issue no	Session	Line	Text	Proposed issue
1	Session1	**307**	Rebecca 11:12 googles acting up im just going to do stop it	Google - internet
2	Session1	**369**	Calvin • 29 mins Heather it wont let me share it with you	permission and sharing
3	Session1	**370**	Maryjane 11:18 i click it and it delete it	User error
4	Session1	**439**	Rebecca • 25 mins Teacher1 can you invite Henry to the doc because I can't ☹	permission and sharing
5	Session1	**471**	Sophie • 27 mins it wont let me share the doc	permission and sharing
6	Session2	**237**	Amy 11:12 can I have permission please	permission and sharing
7	Session2	**323**	Heather 11:04 For some reason, I can't edit?	software issue/ personal issue
8	Session2	**363**	Heather 11:49 Oh no, it didn't link. Ok	hyperlink issues
9	Session2	**606**	Colin 11:13 sorry my wifi just pooed on me	Internet issues
10	Session3	**381**	Colin 11:33 that link isnt workin the one for Sophie	hyperlink issues
11	Session3	**388**	Sophie 11:33 i think i cant do a link right now coz the wifi im with has an education filter on it	wifi eduation/parental controls
12	Session3	**578**	it wont let me it says pug in is not suppotred	plugin issues
13	Session4	**579**	Jared 10:28 i cant type :/	typing issue on Google doc - browser refresh