The impact of Project-Based Learning on the development of Transversal Skills: A case study approach

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Abstract
The aim of this study is to contribute to the ongoing discourse relating to the value and assessment of Project-Based Learning (PBL) and transversal skills, with relevance to regional and national education policy-making and practice. In September 2021, 1670 students and 150 tutors participated in an evaluation of a PBL experience at South Eastern Regional College (SERC), Northern Ireland. The impact of the PBL experience was measured by the development of transversal skills. Research instruments comprised three focus groups for students, two focus groups for staff, and surveys of all participants. Results indicate very strong progression of transversal skills across all defined categories, and that this progression is specifically attributable to the PBL experience. Student survey results showed that as a direct result of the PBL experience, 19% of students intended to start a business, which compares to the average rate for total early-stage entrepreneurship of 6.5% in Northern Ireland. Staff survey results showed significantly increased enjoyment of teaching and improved efficacy of student learning. Further conclusions and recommendations are additionally identified.

Keywords
Project-Based Learning (PBL); transversal skills; further education; entrepreneurship.

Introduction

The Classification of Skills

Skills have been grouped together in a number of ways to form a variety of skill sets. Soft skills are recognised to be a particular set of non-technical, transferable skills (communication; numeracy; Information Communications Technology (ICT); teamwork; problem solving; improving own learning and performance) that are commonly needed in a range of activities in education, work, and life (NI Direct, 2019). Non-cognitive skills (personal traits; attitudes; motivations; socio-emotional regulation; ability to work with others) involve patterns of thought, feelings and behaviours that are socially determined and are developed throughout life, education and training to produce value, including positive effects on employment (West, 2014; Borghans et al., 2008; Heckman, 2008).

Transversal skills are considered to encompass both soft and non-cognitive skills, which are thereby transferable to any area of knowledge or role (Widayanti et al., 2019; Sa and Serpa, 2018; Viska Project, 2017). Transversal skills were envisioned during the Bologna Process in 1999 (Oleškevičienė et al., 2019) and are considered necessary for personal fulfilment, active citizenship, social inclusion, and employment, as they are essential in the knowledge society, and can be learned, are required to adapt to change, and enable meaningful and productive lives (Recommendations of the European Parliament and of the Council, 2006).

Six transversal skills categories were compiled by UNESCO 'Bangkok' (2014) and UNESCO 'Bangkok' (2016) as shown in Table 1. However, there are slight variations on how transversal skills are framed by different sources and there is a lack of consensus on definition (Viska Project, 2017). Accordingly, the '*other*' category in Table 1 was added to the UNESCO 'Bangkok' (2016) framework to enable the addition of non-categorical transversal skills, highlighting the variability of such frameworks in practice

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(UNESCO – UNEVOC, 2019). Thus, all frameworks tend to encompass the same skills, but they are categorised differently to highlight those deemed to be most relevant in a specific situation or role.

Table 1. Transversal skills (UNESCO 'Bangkok' 2016; UNESCO 'Bangkok' 2014).

Category	**Example Skills**
Critical and innovative thinking	Problem solving, creativity, conscientiousness, entrepreneurship, ability to learn
Inter-personal skills	Presentations, communication, organizing, teamwork
Intra-personal skills	Self-discipline, enthusiasm, perseverance, self-motivation
Global citizenship	Tolerance, openness, respect for diversity, cultural understanding
Media and information literacy	Locating and accessing information, analysing and evaluating media content, digital competence, numeracy and statistics
Other	Inclusion of competencies that may not fit a particular category

The Significance of Transversal Skills

Traditional memorisation-orientated taught courses without active practical activities potentially have little effect on learning outcomes (Mohammed, 2017). Hence, Skola 2030 (2018) conveys how transversal skills help acquire knowledge in different contexts and through different thinking and self-guided learning techniques, thereby strengthening the linkage of new knowledge with personal experience, and independent application of skill in different situations. Indeed, transversal skills largely determine the competitiveness of each member of society and the development of society as a whole (Andersone et al., 2019), with employers expressing their employee skills preferences as lists of desired transversal skills due to their universality and importance, to select the most competent workers for each position (Sa and Serpa, 2018; CEDEFOP, 2013). Recent research (Sa and Serpa, 2018; Mohammed, 2017) concludes that transversal skills are important because of their socioeconomic impact, and that consistent correlation has been identified between positive mental health outcomes and successful exercise of transversal skills (Ievers et al., 2022). Currently, however, there is commonly a lack of inclusion of transversal skills development in national curricula and assessments, in contrast to traditional pedagogic or curriculum strategies that are predominantly theoretical, involving judgemental rote learning and memorisation skills, and high-stakes testing (Sa and Serpa, 2018; Mohammed, 2017). As described by Au (2007), high-stakes testing is exemplified by national examinations, where pupils answer strictly controlled, formal and predominantly written test papers, which are then graded against agreed national standards. Examples would include the United Kingdom's G.C.S.E. (General Certificate of Secondary Education) examinations (CCEA, 2022), as typical of national standardisation. Au (ibid) argues that the consequence of such high-stakes testing is a narrowing of the curriculum of subject matter to focus upon the tested elements, with the classroom experience dominated by a teacher-centred approach to maximise test performance.

Project-Based Learning (PBL)

Project-Based Learning (PBL) is a student-centred, active, and engaging approach to learning and transversal skills development (Hoe et al., 2019) and it is suggested that students will retain content

longer and with more understanding if they learn through PBL (Penual and Means, 2000). PBL activity is not new: the concept was originally introduced into formal education structures by Dewey (1900), who established an experimental school in Chicago in 1897 (Cremin, 1961). Dewey's pioneering work in PBL is consistent with social constructivist theory, whereby teachers create conditions in which learners can take responsibility for constructing their own knowledge frameworks (Roessingh and Chambers, 2011). PBL students are seen to be more self-reliant and have better attendance than in more traditional settings (Walker & Leary, 2009). PBL develops transversal skills such as: critical thinking; collaboration; communication skills; research skills; negotiation skills; presentation skills; problem-solving skills; ICT skills; self-confidence; creativity; ability to plan and develop ideas; teamwork skills; motivation; persistence; learning to learn; and positive attitudes (Widayanti et al., 2019; Mohammed, 2017). This is echoed by McCrone et al. (2017) who recorded several of the positive impacts that PBL has had upon University Technical Colleges students in England, notably an improvement in academic learning and technical skills, and an increase in transferable 'work-ready' skills. As Widayanti et al. (2019) discuss, PBL is a real-world, meaningful learning approach, requiring students to organise themselves in a team, manage a project, make decisions and find solutions.

Transversal Skills and PBL in Northern Ireland

In 2017, the Department for the Economy (DfE) of Northern Ireland (NI) published, '*Economy 2030: A consultation on an Industrial Strategy for Northern Ireland',* with a vision to create a globally competitive economy. Economy 2030 articulates various needs, such as equipping people with education and skills that will allow them to achieve their full potential, supporting those who need help to access the skills that will help them compete for employment, and delivering new models of youth training and apprenticeships that facilitate progression of skills across a wide range of occupational areas. As concluded by Ievers & McGeown (2020, p.46), "*future provision* [in NI] *demands political commitment to a radical review of curriculum and teacher education, which moves away from high-stakes testing as defined by Au (2007) and embraces inquiry-based learning (IBL)* [synonymous with PBL]".

Within this context, the NI Level 2 occupational framework for Traineeships and Apprenticeships (2019) requires the development of eight transversal skills categories (Table 2.). The traineeship programme is focused upon ensuring that work-ready skills are developed, but critically, the framework is geared towards practice, and provides an example of how transversal skills can be assessed in response to identified social and economic priorities. The selected transversal skills are listed in the left-hand column of Table 2, and corresponding descriptors of observable progression are listed against each to provide a measurable level of achievement. The collection of these achievement levels then presents a profile of the individual.

Table 2. The Northern Ireland Level 2 occupational framework for Traineeships and Apprenticeships.

Transversal skill	Initial Within the first three months	Interim By the end of the first 12 months	Final By the end of the traineeship
Self-management	Ask for direction and clarify understanding of instructions received Work in a way that takes responsibility for own safety	Plan own work to meet the needs of the tasks given Undertake learning proactively	Track emerging trends in hospitality in Northern Ireland Commit to self-development plan, reflecting and identifying next steps
Working with others	Take on the viewpoints of others Make connections with colleagues and other relevant stakeholders to establish working relationships	Listen to others' point of view and consider their viewpoint when planning own work Liaise with other teams in the organisation	Work with colleagues and other stakeholders in own and other teams to ensure effective outputs
Citizenship/ participating in society	Understand the basic profiles of customers and team members Respect the differences of individuals, including disability, ethnicity background, gender, sexuality and religion in own and other teams	Understand how individuals' differences, including disability, ethnicity background, gender, sexuality and religion impact upon the way the organisation develops, offers and produces the menus and styles of service	Challenge own perceptions of individuals' needs Work proactively to produce dishes which meet individual needs
Work professionalism	Be on time, in correct uniform with the required equipment Be polite and respectful to colleagues, customers and visitors	Uphold the organisation's standards when working in the hospitality organisation Report issues with ingredients or equipment which may affect dish quality	Set an example to team members by living the values of the organisation at all times, being positive about the organisation externally
Problem solving and decision making	Identify when a problem needs to be solved and seek the required assistance	Learn from own mistakes and those of others to inform improved future performance	Propose alternatives / solutions when there are problems with dishes, ingredients or equipment affecting work
Numeracy and use of data	Ensure the right amount of each type of resource is obtained for tasks	Look for economies of scale and ways to maximise efficiency in work tasks	Utilise knowledge of costs and pricing to work efficiently. Participate in stock taking
Digital literacy	Conduct self in a professional manner when on personal social/digital media	Use basic software packages relevant to role, such as email systems	Use organisation's software for stock, ordering and recording in line with role
Literacy and communication	Record use of resources and wastage and stock records accurately. Communicate with team members clearly and concisely	Produce accurate written descriptors when required. Communicate with team, other teams and stakeholders effectively	Consistently use effective two way communication face to face, remotely and in writing throughout the role

South Eastern Regional College (SERC) of Further Education

Over the past decade, SERC in Northern Ireland has been innovating PBL. SERC has encountered challenges to its development of PBL, such as resourcing the implementation within existing budgets in the absence of additional governmental funding, prescriptive curriculum requirements and lack of recognition of PBL by Awarding Organisations (AOs). AOs traditionally design curricula within standalone modules, which is an approach that supports a silo-based delivery of learning and assessment mechanisms that are focused upon students working as individuals (Sa and Serpa, 2018; Mohammed, 2017; Au, 2007). These constraints work against the fundamental principles of PBL, where students work in groups and learn from each other as well as from their tutor, and where there is an integrated approach to projects that works across modules and is focused upon continuous assessment to allow students to build skills over time. Nevertheless, the management at SERC has invested significantly from its own resources to enhance the expertise of staff and overcome such challenges to successfully deliver PBL across an increasing number of courses in the College. SERC has created a 12-step PBL model, based both upon the 'CDIO' initiative (Stanford, 2011), which provides students with a framework of Conceiving, Designing, Implementing and Operating (CDIO) within a context of real-world systems, and also upon the challenge-based learning model used by Tknika Centre of Innovation in the Basque Region (Tknika, 2019), which combines a range of technical and social skills within a range of challenges designed to support collaborative learning. SERC's 12-step PBL model similarly provides a context for all learners to work in multidisciplinary collaborative projects.

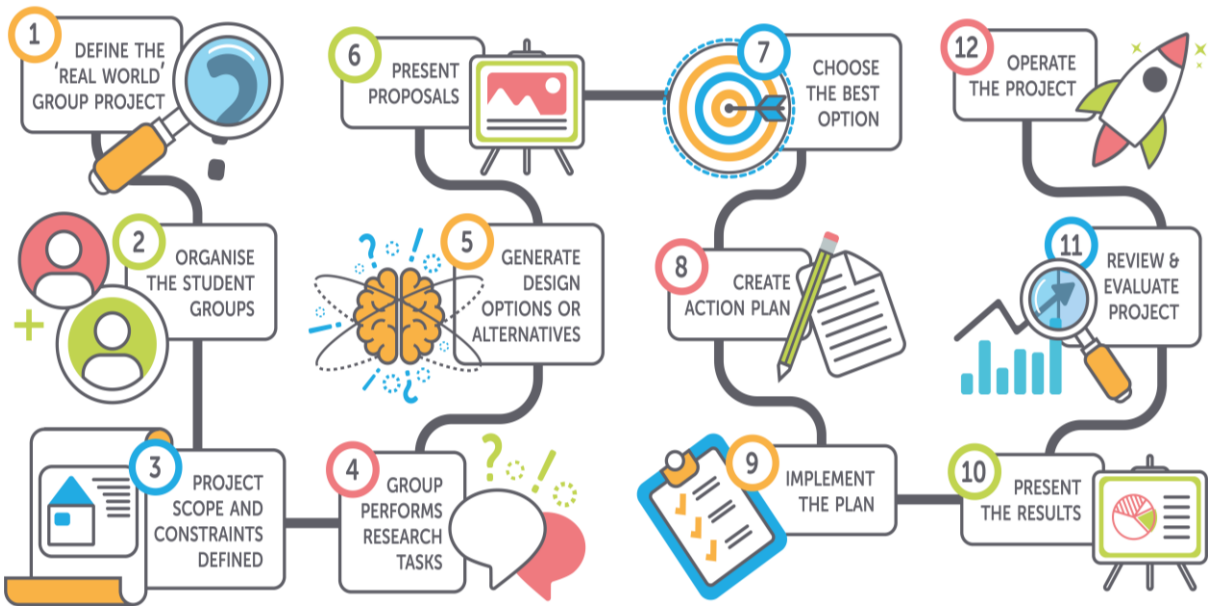

Figure 1. SERC's 12 step PBL model.

Consistent with the UNESCO 'Bangkok' (2016) recognition of the need for contextual application, SERC developed a 'T-skills' (Transversal Skills) model, with a clear correlation between the categories of the T-skills Model and the UNESCO classification (shown in parentheses): Digital Literacy (Media and Information Literacy); Citizenship (Global Citizenship); Working with Others (Interpersonal); Problem-Solving and Decision-Making (Critical and Innovative Thinking); Self-Management (Intrapersonal); Work Professionalism (Other), defined by SERC as the student's approach and attitude to study and work.

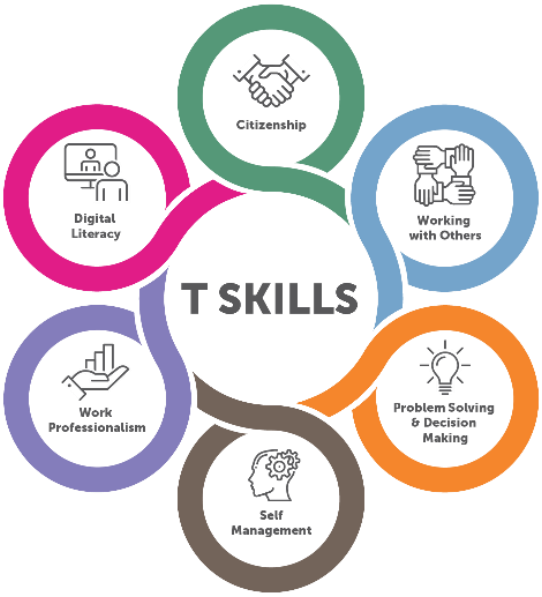

Figure 2. SERC's T-Skills Model.

SERC further divided the T-Skills into Supporting Skills, as shown in Table 3. and constructed a framework (Table 4.) of assessment descriptors that could be applied to PBL activities to measure improvement, which is a progression from the framework used by the NI Traineeships and Apprenticeships (Table 2.).

Table 3. Transversal Skills descriptor framework developed by SERC.

T SKILL	SUPPORTING SKILL	DEFINITION
Citizenship	Citizenship	Ability to confidently demonstrate intercultural understanding through working in diverse groups.
Working with Others	Verbal and Non-Verbal Communication	Ability to confidently express themselves using clear verbal and non-verbal communication. (Language production).
	Listening and Empathy	Ability to listen and take on board information. Can understand others' perceptions, opinions, concerns and can provide respectable feedback when appropriate. May include others and create space for their opinions and concerns. (Reception & communication).
Problem-Solving and Decision Making	Creativity and Innovation	Ability to identify problems and come up with effective solutions and make decisions using innovative and creative thinking.
Self-Management	Self-Initiative	Ability to identify and take opportunities, to use self-initiative and recognise how important this is in personal development.
	Risk	Ability to undertake tasks beyond comfort zone and to calculate risks, make decisions and be accountable.
	Resilience	Ability to accept and adapt to change, challenges and difficulties, taking positive action.
	Time Management	Ability to identify tasks and plan, prioritise and adapt when faced with changing circumstances.
Work Professionalism	Commitment	Ability to maintain a professional attitude, showing consideration and respect for others in the workplace.
Digital Literacy	Health, Safety and Security	Ability to stay healthy, safe, and legal online – protecting data, identity and wellbeing, including online transaction and digital footprint
	Information and Data Literacy	Ability to handle information – find, interpret, and evaluate information and data from multiple sources using a range of devices.
	Digital Content Creation	Ability to identify and use appropriate software to design and display content for different purposes and audiences including e-portfolios
	Connecting and collaborating effectively online	Ability to interact with others - communicate, collaborate and network effectively using digital tools for projects and social interaction
	Learning and working online	Ability to learn and work in a blended environment - using digital tools to learn, manage tasks and complete assessments /assignments.

Table 4. A sample of the Assessment Matrix Progression developed by SERC.

Working with Others: Listening and Empathy

WORKING WITH OTHERS: LISTENING AND EMPATHY

THE ABILITY TO LISTEN AND TAKE ON BOARD INFORMATION. CAN UNDERSTAND OTHERS' PERCEPTIONS, OPINIONS, CONCERNS AND CAN PROVIDE RESPECTABLE FEEDBACK WHEN APPROPRIATE. MAY INCLUDE OTHERS AND CREATE SPACE FOR THEIR OPINIONS AND CONCERNS. (RECEPTION & COMMUNICATION).

Pass	Merit	Distinction
Shows understanding of instruction, confirming verbally or via gestures.	Shows understanding of instruction through clear verbal communication or gestures. Uses questions to clarify instructions when required.	Shows clear understanding of complex instruction. Reiterates and summarises information to others.
Nodding, yes or no replies, does not interrupt.	'Yes, I understand, but does the research need to be primary?' Restates accurately. Unprompted acknowledgement of information.	Can pass (complex) information on to group, can clearly summarise instructions back to lecturer, detailed note-taking.
Listens to other people's perceptions, opinions and concerns.	Listens to and responds to other people's perceptions, opinions and concerns.	Listens to and responds constructively to others' perceptions, opinions, and concerns. Encourages and supports others to share.
Will let others in the group speak. Does not interrupt. Allows speakers to remain on topic. Takes minutes during meetings.	Acknowledges different opinions and concerns about a task or project, respects differing points of view and remains on task, defers judgment, adapts approach according to context.	Listens to others and asks questions to further understand their point of view, gives respectful advice or feedback when appropriate, ensures everyone can participate in discussion, invites others to contribute, diffuses conflict, challenges opposing views constructively where appropriate.

This case study will address four research questions to evaluate the impact of PBL activities upon the development of transversal skills:

1. To what extent do staff and students perceive that PBL activity develops transversal and other skills amongst students?
2. What do staff and students perceive to be the benefits and limitations of PBL and how might the PBL experience be improved?
3. Do staff and students perceive PBL to be a useful vehicle to develop enterprise and entrepreneurial mind-sets?
4. Do students and staff consider PBL to offer a more enjoyable learning experience in comparison to more traditional didactic class/desk-based learning?

Methodology

The aim of this case study was to investigate the impact of an intensive PBL experience over a two-week duration, with respect to the development of students' transversal skills from the perspectives of both staff and students. As defined by Bassey (1997), an educational case study approach was adopted. The educational case study is an empirical approach, which is focused upon a specific and limited sample at a particular time and within a 'real-world', or practical and relevant setting. It additionally requires collection and analysis of sufficient data to support investigation of educational actions, with the aim of informing practitioners and offering contribution to policy.

Research Design

The study employed a multi-methods approach with a combination of surveys and focus groups. The advantages of surveys include the ability to reach all participants with greater ease and rapidly gather responses to specific questions. However, a primary disadvantage is the limited ability to probe responses in depth, due to the restriction of having no flexibility in the questioning process, such as asking further questions once a survey has been deployed. Yet, this limitation is directly addressed via the advantage of using follow-up focus groups (Cohen et al., 2018).

Winlow et al. (2012) argue that qualitative methods are particularly suitable for pedagogic research, due to the ability to provide informative insights into student experiences of the teaching and learning environment. Focus groups obtain data from a purposefully selected group of participants rather than from a statistically representative sample of a broader population (Nyumba et al., 2017). Thus, they can enhance understanding of issues and enable group reflection on the effectiveness of teaching approaches (Winlow et al. 2012; Denscombe, 2010). Focus group data collection usually involves either audio recording or note-taking, or both, although recording discussions is considered to provide the most complete record of the conversation and removes the potential biases of hand-written notes (Winlow *et al.* 2012; Stewart *et al.* 2007).

However, Lam et al. (2012), having reviewed Manfredi et al. (1997, p.798), suggested viewing focus groups as an additional strategy; incorporating other evaluation methods to the research design as multiple methods can provide complementary and comparable data. Focus groups are time and resource intensive, but they can be combined with qualitative or quantitative surveys to collect information quickly from a large group; participants from the surveys can be selected for participation in the focus groups to provide additional depth on some aspect of the phenomenon under study (Winlow et al. 2012; Adams and Cox, 2008).

In considering these advantages and disadvantages, the use of surveys provided a larger data set for study, reinforced with focus groups to probe in-depth on emerging themes. Therefore, the disadvantages of surveys are countered by the advantages of focus groups and vice-versa, providing

a complementary and mutually reinforcing multi-methods approach to both data collection and analysis.

Data Collection Procedures

The suggested maximum time for a focus group is approximately 40 minutes, as participants could suffer fatigue if longer in duration (Nyumba et al. 2017; Winlow et al. 2012). Focus groups will usually comprise 5 – 12 participants, so that time can be best utilised, and all participants can be appropriately included in the discussion, with enough time and attention to have their opinions heard and for discussion to develop (Winlow et al. 2012; Wibeck et al. 2007; Hyden and Bulow, 2003; Longhurst, 2003; Fallon and Brown, 2002; Cameron, 2000). Accordingly, the focus groups within this study were limited to a period of 40 minutes and each focus group comprised between 8 and 12 participants. Additionally, focus group responses were recorded using a voice recorder.

Three empirical data collection stages were required:

Stage 1. The student and staff surveys;
Stage 2. The student focus groups were conducted to target specific themes that emerged from the student and staff surveys;
Stage 3. Given the role of staff as PBL facilitators, the staff focus groups were conducted taking into consideration the data obtained from both the student and staff surveys as well as the student focus groups.

The surveys were delivered and the data collected electronically. The surveys and focus groups were conducted on SERC's campuses, as participants were likely to feel more comfortable in familiar surroundings (Winlow *et al.* 2012). A pilot study was conducted to test and proof the student and staff questionnaires to ensure quality, reliability and validity. Responses from three students and two staff identified merely a minor amendment required to clarify the meaning of one question in the students' survey, but also supported discussion that confirmed correct identification of the range of relevant issues in both questionnaires.

Two student surveys were conducted. In order to capture benchmark data, the 'Pre-Induction' survey was conducted at the beginning of the PBL experience (entitled, the 'Enterprise Fortnight') for 1st and 2nd year students; the 'Post-Induction' survey was conducted at the conclusion of the PBL experience in order to capture comparative data and perceived change that might be thereby directly attributable to the PBL experience. The questions in both the Pre-Induction and the Post-Induction questionnaires were aligned to the descriptors in the SERC assessment framework (illustrated in Table 4.). Each question was worded to evidence particular transversal skills that are expected to emerge from the associated experience, or opinions on PBL and its success, from the student perspective. In addition, several background questions were asked at the beginning of the survey to gather non-identifiable demographic data to enhance analysis.

The measured variables in the staff survey were based largely on the success factors of PBL and student progress, to answer Objectives 1 to 4. These variables were facilitator-orientated rather than student-orientated. Thus, in this case, the questions were grouped firstly on non-identifiable background demographics, secondly on the impact of PBL (including training) on staff, thirdly on the impact of PBL on students, and lastly, on suggested improvements and further comments all from the staff perspective.

Both student and staff surveys shared an analogous response measurement scale for non-demographic and comment style questions, ensuring consistency, and enabling comparison during analysis. A four-point Likert scale was purposely selected to avoid a 'middle' or average option, which

can too easily be interpreted as having many meanings. This helped to overcome the bias resulting from the tendency of respondents to select the middle option and better ensured that responses to questions were representative of positive or negative opinion (Pornel and Saldana, 2013). Participants were restricted to selecting one option only that best reflected their opinion.

The student focus group questions were derived from the themes that emerged from both the student and staff surveys. Likewise, the staff focus group questions were derived from the themes that emerged from both the student and staff surveys, but also took into consideration the added research data from the student focus groups (Winlow et al. 2012; Cameron, 2000).

Participants and Sampling

Winlow et al. (2012) suggest that in an educational context, a purposeful sample or natural group of participants may be of greater value than a random sample, because if the surveys and focus groups are designed to investigate students' learning experiences, they should consist of participants who have been exposed to similar experiences.

Participants in the two student surveys were all students at SERC who completed an intensive PBL experience at the beginning of their academic year. As part of their PBL project, all participating students were informed of the opportunity to additionally take part in the survey, and of the importance of the research. Those who then completed the online survey did so voluntarily. All staff who deliver PBL were similarly informed of the relevance of the research and given the opportunity to take part in the staff survey. Again, those who completed the online survey did so voluntarily.

In order to adhere to the ethical guidelines of Stranmillis University College and to ensure reliability of focus group outcomes, procedures were implemented to both protect anonymity and achieve samples that were representative of the range of relevant demographic factors. Students and staff who wished to participate in the focus groups emailed the lead researcher using either their SERC email address (which was coded for students and unidentifiable to the researcher) or a private email address (which would be unidentifiable to the researcher). The researcher then confirmed arrangements for the focus groups, with participants using only Christian names. Some students might have recognised or known each other, but within a large potential population of over 1600 participants, such recognition was minimised. Staff would have been much more likely to know each other, but the staff focus groups contained either only managerial or only non-managerial staff. Nevertheless, focus group participants would have been able to derive some support from the presence of their peers, while also ensuring that each participant had the opportunity to contribute to discussion, and avoiding issues of non-participation or dominance by a minority, which can be a challenge for focus groups (Cohen et al., 2018).

Data Analysis

The collated survey responses were analysed in five stages:

Stage 1: Analysis of each demographic variable;

Stage 2: Uni-variate analysis of each Likert-scaled transversal skill variable producing percentage values for the positive and negative response options;

Stage 3: A weighted percentage was calculated for each supporting transversal skill component that was defined by SERC (Table 3) (Equation 1). The weighted percentage proportionately allocates higher weighting to the 'definite' responses, as opposed to the relative responses, whilst reflecting the positive and negative responses with the corresponding mathematical operator. The analysis enabled production of a weightings chart:

$$\text{Weighted Percentage} = \left[2r_{\%_1} + r_{\%_2} - r_{\%_3} - 2r_{\%_4}\right] \quad \text{...Equation 1}$$

$r_{\%_1} = \text{'definitely' response percentage}$
$r_{\%_2} = \text{' more often' response percentage}$
$r_{\%_3} = \text{'sometimes' response percentage}$
$r_{\%_4} = \text{' definitely not' response percentage}$

Stage 4: Coding of open-ended responses to provide additional insight for comparative analysis with the previous results (Newby, 2010).
Stage 5: Interpretation of results, discussion of limitations and findings.

Survey data were open coded and then analysed by constant comparison by the lead researcher, before being subject to scrutiny by co-researchers (Newby, 2010). The student focus group data was then similarly analysed by constant comparison to the survey analyses (Cameron, 2000).

In a similar fashion, the staff focus group data was analysed individually and together to identify trends or themes. This information was then compared with all previous data from both student and staff surveys, and student focus groups through the standard process of triangulation or cross-checking of all results (Winlow et al. (2012); Denscombe, (2010)).

Ethical Considerations
There were no perceived ethical, physical and/or psychological risks associated with the study undertaken. The surveys and focus groups were implemented on the SERC campus, which has appropriate health and safety measures already in place. The surveys and focus groups required no additional activity that would have posed a risk to either student or staff participants. Ethical approval was granted by the Research Office of Stranmillis University College, Belfast.

Winslow et al. (2012) highlighted the importance of informing participants of the aim of the research and their right to withdraw before they participate. Thus, participation was voluntary, with consent requested within the introduction to the survey and consent forms used to volunteer for the focus groups. Within the questionnaire introductions, and within the introductions to every focus group, the right to withdraw at any time without reason was emphasised.

Confidentiality was secured by ensuring that all information was digitally stored and anonymised at the point of interaction. Student and staff participants were made aware of the anonymisation process as advised by Winlow et al. (2012). Collected data was transferred to Stranmillis University College and stored there under password protection for the duration of the project, after which, it was destroyed. The focus group responses were verbal and recorded using a voice recorder, and no visually identifiable information was recorded e.g. photographs or video. These responses were transcribed digitally, disassociating the voices from the responses. Focus group participant names and identifiable personal information were not recorded. All voice recordings no longer required for the purpose of the research, were erased.

Results and Discussion
Introduction
The Pre-Induction survey response rate was n=2283, or approximately 56% of the total student population. The purpose of the Pre-Induction survey was to provide focus for the students at the outset of the Induction experience, and to set the context for the Post-Induction survey. Additionally, random sampling of a student's responses to the Pre-Induction questionnaire was tracked to that same student's responses to the Post-Induction questionnaire to check for consistency.

The Post-Induction survey response rate was n=1670 or approximately 41% of the total student population. Approximately 57% of respondents were studying at SERC for the first time. Approximately 62% of respondents were aged between 16 and 20, 12% between 21 and 25, 6 % between 26 and 30, and 20% were aged over 30 years. 48% of respondents identified as female, and a wide range of study courses was identified. The Post-Induction survey focused predominantly upon reported and perceived changes that could be directly attributed to the Induction experience.

The purpose of the demographic analysis was to ensure that the sample was representative of student population across age, gender and course of study. There was a clear majority (62%) of respondents aged 16 to 20, but this reflects the student population. Significance testing was conducted to investigate response patterns that may be peculiar to demographic categories, but no anomalous trends were identified, particularly given the small numbers of some categories.

Analysis of the Post-Induction survey results is shown in Figure 3. The bar chart overwhelmingly demonstrates significant positive benefit attributed directly to the PBL experience across every category of transversal skills, as defined by UNESCO ‘Bangkok’ (2014) and UNESCO ‘Bangkok’ (2016), and across every category of transversal skills, as defined by SERC in Table 3. as ‘T-Skills’. The wording of the questionnaire emphasised that responses should focus upon changes that occurred as a result of the PBL experience. Focus group questioning maintained the same focus. Furthermore, the timeframe for reported change was deliberately limited to the two-week Induction experience to minimise the potential impact of any external experience. It would be argued that an external experience would be unlikely to impact to any significant extent the development of transversal skills at exactly the same time and in such a short period of time. Therefore, all other variables cannot be eliminated, but their likelihood has been reduced as far as possible, and within practical considerations, to a low level.

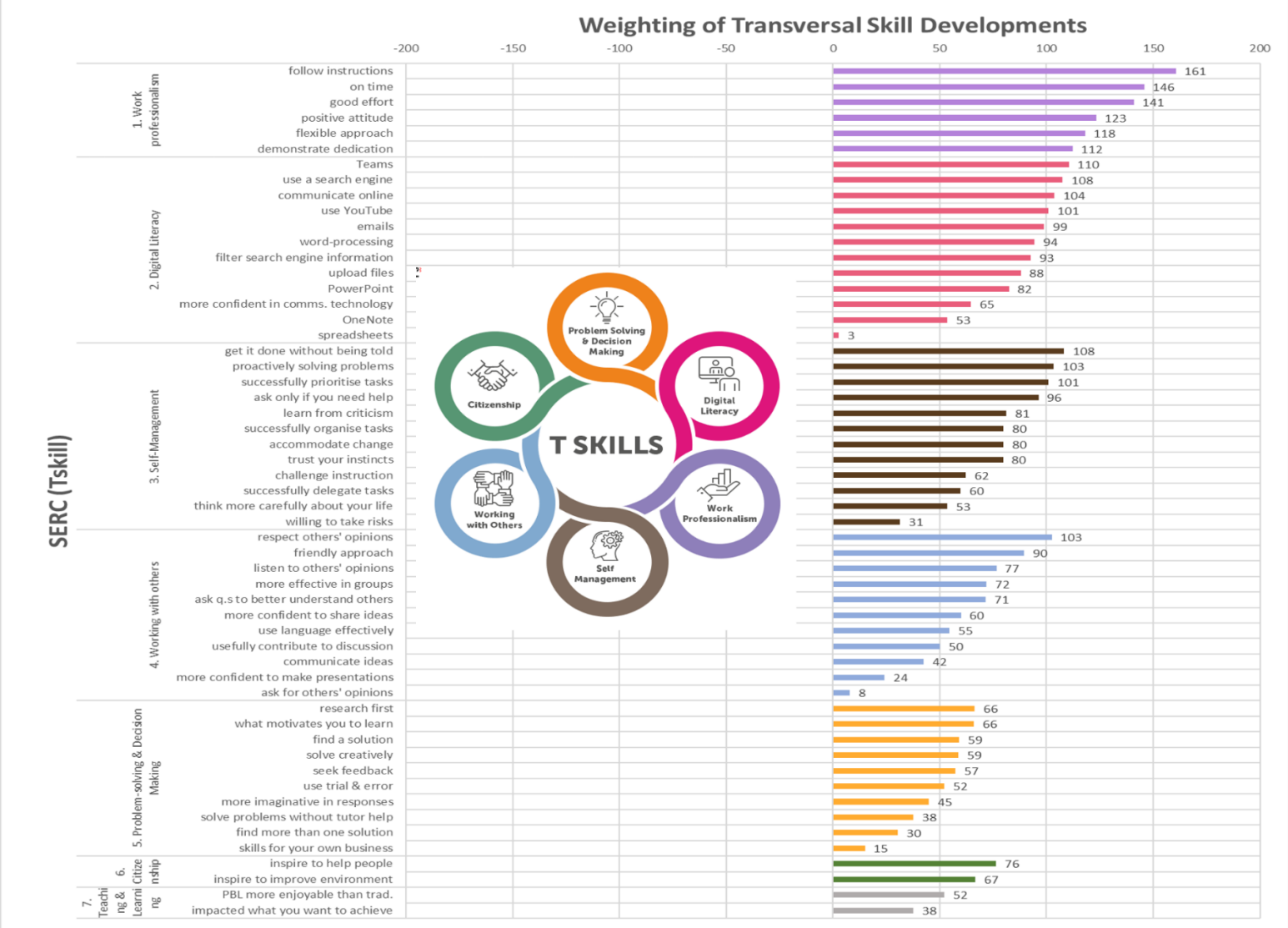

Figure 3. Weighted Transversal Skill Development as a result of PBL.

Elements of the context are of particular importance: many of the students embarking upon the PBL experience will not have encountered PBL before; the recorded impact that has been itemised has therefore been achieved despite the necessity of a learning curve, the need to adjust to a range of new situations, and the intrinsic disruption to students' perception of the 'normal' model of educational delivery and assessment. The recorded impact is additionally achieved within a time period of two weeks.

The staff survey response rate was n=138, or approximately 46% of the total staff population. The average median years' service at SERC was 14; the average median age was 46.
18 students and 13 staff took part in focus groups. As the focus group participants were volunteers, it may be reasonably assumed that demographic patterns remained broadly similar, which would be a contextual reference for the quotations within the following results.

Results will be presented within the narrative of the four research questions.

1. *To what extent do staff and students perceive that PBL activity develops transversal and other skills amongst students?*

Within the SERC T-skills category of Problem-Solving and Decision-Making, students reported that as a direct result of the PBL experience they were now significantly more able to solve problems without tutor help, to find more than one solution, to be more imaginative, to use trial and error, to use research and to seek feedback. Within the T-skills category of Citizenship, students confirmed that the PBL experience meant they were much more inspired to help other people and to improve their environment. Within the T-skills category of Working with Others, respect for others' opinions, listening to others, a friendly approach, and asking questions to better understand others were attributes that were reported to have very significantly improved specifically because of the PBL experience, along with more effective working in groups, more confidence to share ideas and make presentations, and more effective use of language and contribution to discussion. Within the T-skills category of Self-Management, students reported that as a direct result of the PBL experience they were now very significantly more able to solve problems proactively and independently, prioritise tasks, learn from criticism, accommodate change, take risks, challenge instruction, delegate tasks, trust their own instincts and think more carefully about their lives. The ability to use Teams software, YouTube, a search engine, and to communicate online were highlighted in particular as advancements within the T-skill of Digital Literacy that came out of the PBL experience, along with much improved skills using PowerPoint, emails and word-processing, filtering information, uploading and use of communications technology. The T-skills category of Work Professionalism displayed scores of the highest affirmation with respect to following instructions, punctuality, industry, commitment and flexibility.

Staff agreed that the PBL experience and the associated transversal skills were more valuable for use in the world of work than preparation gained from traditional classroom practice. Staff considered PBL experiences to be very strongly supportive of transversal skill development.

Staff responses would support the findings of Sa and Serpa (2018), that employers expressed preferred employee skills as lists of transversal skills, and that these would be used to select the most competent workers for each position; staff focus group responses and staff survey results would also reinforce the conclusions of Hoe *et al.* (2019), that PBL is an engaging approach to both learning and transversal skills development. It is noteworthy that students were at least instinctively aware that PBL is a real-world, meaningful learning approach, as discussed by Widayanti et al. (2019).

2. *What do staff and students perceive to be the benefits and limitations of PBL and how might the PBL experience be improved?*

Students identified a number of aspects that they believed would enhance their experience: more time before the PBL experience to get to know their fellow team members would be helpful, although the survey identified positive impact on their collaboration skills; more explanation of the purpose of the PBL experience was requested, along with their expected roles; students recommended more choice regarding the nature and content of the project to be completed, although that this should be balanced within a structure or framework, perhaps with more exemplar material and past participants discussing their experience:

> If you don't like it, you won't be passionate about it and you won't care.

Student requests for clarification of purpose might be informed by reference to the conclusions of Skola 2030 (2018) detailing the linkage of new knowledge with personal experience, and the findings of Andersone et al., (2019), that transversal skills largely determine the competitiveness of each member of society and the development of society as a whole. Staff and students are agreed that, subject to pragmatic considerations, freedom to choose the nature of each project would enhance productive outcomes.

Students identified inherent risks within group work, that a group might hold back the individual, that older students could take the lead, and that one or two group members might do most of the work; from the survey data, however, the group work element was a conspicuous success. Students also commented that the PBL experience would clearly relate to different subject areas in different ways, as would be appropriate to nature of each. Assessing the PBL experience, Hospitality students highlighted:

> It is actually getting ready for a workplace.

Similarly, assessing PBL with relevance to the 'real world' of Hairdressing:

> You <u>do</u> work in a collective environment, and you <u>do</u> work in a team;
>
> Communication is key in any environment, and it is a great structure to use for improving communication.
>
> It definitely challenges you…. changes you…. You find yourself out there talking to this total stranger; you're like, actually, I did shoot this video myself, I edited this video, I put it all together. I did it.

Regarding assessment, students were similarly articulate and apposite:

> You can't just look at the final product, because you've no idea who's put in how much effort.

Students very much appreciated individual assessment meetings with their assessing tutors, and they would have confidence in the accuracy of such assessments, but would be eager that assessment were continual.

The majority of students believed that a 60/40 split between classroom and PBL respectively would be appropriate; for Joinery, as an example, a 70/30 split was preferred. The rationale was clear:

> It's not something that you just come up with and throw it out there…. there is a lot of studying behind every single thing.
> It does open up your skill set and it does teach you a variety of things, you know, that you couldn't necessarily learn within your field.

Similarly, staff affirmed that there may be elements of some courses that could not be delivered through PBL, and that other elements could be adapted for PBL delivery. Some staff pointed out that courses such as Photography are inherently suited for PBL delivery of the full course and are well established in such practice. The consensus was that PBL cannot be a 'one-size-fits-all', and it was proposed that an audit would be appropriate to determine the optimal integration of PBL within each course, with reference to the nature of the subject matter and considerations of pragmatism.

Staff agreed that PBL works best when students have ownership of the project, but said that scaffolding is still required, that students could have a choice, but only within boundaries appropriate to the subject, time, resources, health and safety issues, and consideration of the input of external stakeholders. Staff perceived themselves to be enablers and facilitators. Staff affirmed extensive training for PBL.

Staff confirmed the importance of assessment in providing recognition and value, but balancing this against over-assessment, which would risk a tick-box exercise. They recommended that the assessment mechanism would be tailored to the nature of PBL, and endorsed application of a matrix to reflect progression, such as the framework illustrated in Table 4; such an approach would resonate with the students' request for continual assessment. A further endorsement was the use of the e-portfolio to capture evidence such as video, photographs, peer assessments or notebooks, and from not only PBL, but from part-time employment, for instance, to create a 'life-tracker', which could be much more informative than traditional assessments, and again support the student view that continual assessment is needed. An argument against such a life-tracker would be that it would present too much information, and that the traditional summary of 'high-stakes' assessment grades (Au, 2007) presents a much more concise overview. However, it was pointed out that internet search engines have fundamentally changed the place of knowledge-based qualifications. Some staff advocated traditional high-stakes assessment for theoretical elements of a course, with PBL reserved for assessment of practical components. However, other staff highlighted that some courses, such as those related to the Performing Arts, were already entirely assessed through PBL; such outcomes are consistent with the consensus view that PBL cannot be a 'one-size-fits-all'. Within the context of the common lack of inclusion of transversal skills development in national curricula and assessments (Sa and Serpa, 2018; Mohammed, 2017), the further integration of PBL advocated by both the SERC staff and students would present a distinctively progressive achievement.

3. *Do staff and students perceive PBL to be a useful vehicle to develop enterprise and entrepreneurial mind-sets?*

Significantly, the survey results showed that 19% of students intended to start a business, approximately 300 students. In the 2017 GEM UK Northern Ireland Report (Hart et al., 2017), it was concluded that the rate of total early-stage entrepreneurship in Northern Ireland in 2017 is 6.5%, which has not changed significantly since 2016. The 2017 rate compares to 8.7% in the UK overall, 9.1% in England, 6.3% in Wales, and 6.7% in Scotland. The response of 19% is therefore significantly higher than local and national percentage rates and may be directly attributable to the impact of PBL. It is additionally important to note that the average national rates are significantly lower for the predominant age group within the survey at SERC.

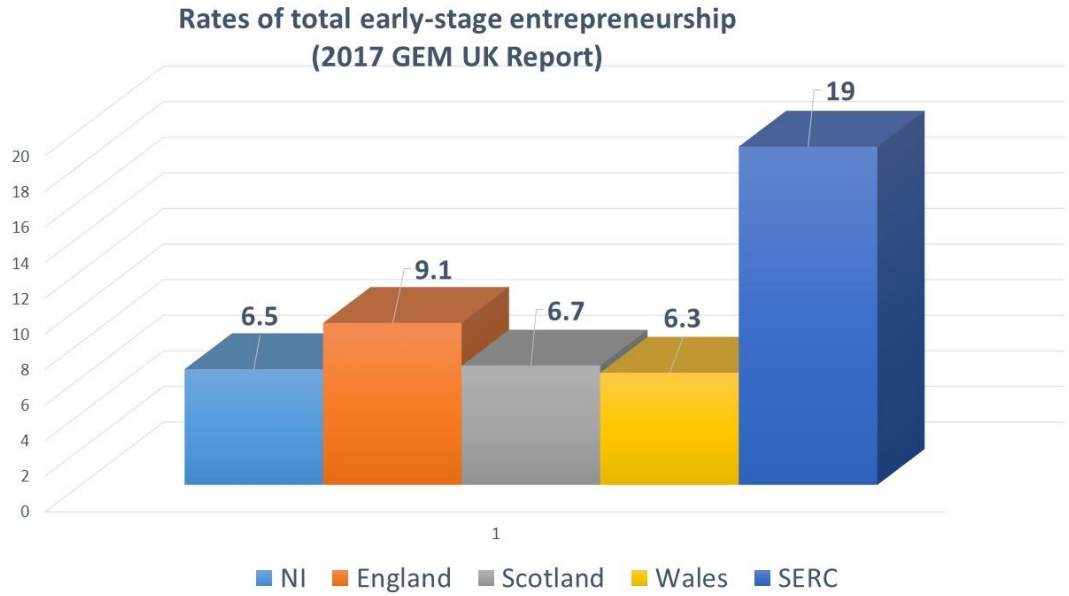

Figure 4. Rates of total early-stage entrepreneurship, from the 2017 GEM UK Northern Ireland Report (Hart et al., 2017).

4. *Do students and staff consider PBL to offer a more enjoyable learning experience in comparison to more traditional didactic class/desk-based learning?*

Within the survey analysis, the majority of students confirmed that the PBL experience was more enjoyable than traditional classroom approaches, and that this impacted what they wanted to achieve in their lives. Staff survey results also affirmed increased enjoyment of teaching and improved efficacy of student learning.

Conclusions

In September 2021, 1670 students at South Eastern Regional College (SERC), Northern Ireland, or approximately 41% of the total student population who participated in a Project-Based Learning (PBL) experience, completed a survey that focused upon perceived changes directly attributable to the PBL experience. 46% (n=138) of the supervising staff completed a corresponding survey. Data were additionally captured from three focus groups of participating students and two focus groups of staff.

Student survey results overwhelmingly demonstrated significantly positive benefit attributed directly to the PBL experience across every category of transversal skills, as defined by UNESCO 'Bangkok' 2014 and UNESCO 'Bangkok' 2016, and across every category of transversal skills, as defined by SERC as 'T-Skills'. Furthermore, the survey results showed that as a direct result of the PBL experience, 19% of students intended to start a business. This compares to the average rate for total early-stage entrepreneurship of 6.5% in Northern Ireland, 9.1% in England, 6.3% in Wales, and 6.7% in Scotland (Hart *et al*., 2017). However, students requested more time before the PBL experience to get to know their fellow team members and more explanation of the purpose of the PBL experience, along with their expected roles.

Staff survey results showed increased enjoyment of teaching and improved efficacy of student learning. Staff considered PBL experiences to be very strongly supportive of transversal skill development and affirmed that transversal skills were more valuable for some 'real world' applications than traditional classroom practice. Additionally, staff confirmed that the assessment mechanism should be tailored to the nature of PBL, and endorsed application of a matrix to reflect progression, such as the framework developed by SERC. Staff endorsed the use of the 'life-tracker' e-

portfolio of video, photographic, written and peer evidence, and advocated traditional high-stakes assessment for theoretical elements of some courses, although a number of SERC courses are already entirely assessed through PBL. Students reported confidence in the accuracy of individual assessment meetings and requested that assessment would be continual.

Within the context of different subject contents, staff and students agreed that PBL cannot be a 'one-size-fits-all' approach across the range of courses studied by participating students. Furthermore, staff and students agreed that, subject to pragmatic considerations, freedom to choose the nature of each project could enhance productive outcomes.

For future research, it may be considered that different career areas will exhibit different transversal skill profiles, that individuals with predispositions to particular transversal skills will develop skill sets that render them well-suited to particular areas of work; successful entrepreneurs, for instance, would display a particular pattern of dominant transversal skills. The theoretical framework for Transversal Skills is well established, and provides an opportunity for such investigation. Further proposals would include longitudinal studies to track the impact of the PBL experience over the longer term.

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