Chemistry Education Research and Practice

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Investigating the transition into third level science – identifying a student profile

Cite this: *Chem. Educ. Res. Pract.*, 2013, **14**, 62

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Research into student transition to and experience of first-year undergraduate study has been ongoing for many years. The corresponding research within the discipline of science has been less prolific and that which has been published tends to focus on using external factors such as previous grades, finances, travel time *etc.* as predictors for student success and retention. While these studies are valuable in identifying possible impacting factors, many of these factors are out of the control of university academics. In this study an attempt is made to examine the transition experience from a more student-centred approach, by identifying a student profile at the transition stage on entry to undergraduate science that is based on a conceptualisation of learning. It uses this profile to identity potential areas for academics to build upon student strengths and expectations of university study with the aim of highlighting opportunities to ease the transition period for both students and academics and to ultimately improve student integration and performance.

Received 9th August 2012,
Accepted 15th October 2012

DOI: 10.1039/c2rp20107k

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Introduction

Over the last 20 years there has been a substantial increase in students accessing higher education. There has been an approximate increase of 25 percentage points in access to tertiary level programmes across OECD countries between 1995 and 2009 (OECD 2011 p. 308). With these increased numbers, cross-discipline research on student transition into tertiary education, the first-year experience and retention, though well established, have become more prevalent. Harvey *et al.*, (2006) reviewed the literature in this area and identified four main areas of inquiry into the first-year experience.

- Performance and retention, including predicting success, assessing performance and withdrawal and retention
- Factors impacting on performance and persistence including institutional, personal and external factors
- Support for the first-year, including induction, adjustment and skill support
- Learning and teaching, including new techniques for first-year groups and first-year learning behaviour

He notes that some caution should be considered making generalisations as the majority of research conducted into these areas is largely made up of small one-off studies in which many depend on registry data, grades and, to a small extent, satisfaction ratings to identify significant factors impacting on the general first-year experience and retention. However, he does present a summation of commonalities, a synopsis of which is given in Table 1. Ulriksen *et al.*, (2010) provide another excellent review of this area. His review reflects many of the factors noted by Harvey *et al.*, (2006). He reports that there are various models exploring issues of student dropout and integration, which come from different psychological and sociological perspectives. It is noted that there is a tendency for US studies to focus on factors around social and academic integration, identity and culture whereas UK studies tend to focus on preparedness and expectations for university.

The phenomenon of student difficulties in transitioning from second level into university education is not new. In 1989, Upcraft and Gardner, 1989 stated that, '*Many students enter higher education environment with little preparation, having little idea of what to expect, and little understanding of how university can affect their lives*'. It is further noted that incorrect perceptions and expectations of university can lead to student underperformance and high student dropout rates at university (Yorke, 2000). It is generally accepted that the initial weeks in university are the most crucial in terms of retention of students, but also in helping to improve the quality of learning (McInnis, 2001). In some universities there are introductory courses and online supports available to help students make the transition from second level. Suggestions of good practice from Yorke, (2000) Tinto, (1994), tend to focus on institutional concerns such as amount of content provided in induction, provision of information about courses, availability of support services *etc.* Indeed reports on support courses have shown that participation on these can be beneficial

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Table 1 Research orientations and outcomes of the first-year experience (adapted from Harvey *et al.*, (2006))

Performance and Retention
- Most research on success predictors attempt to identify a simple determining factor
- Secondary school grades and special tests do not closely link to first-year performance
- Prior subject knowledge and grades achieved in the early stages of first-year are good indicators of success in combination with other variables
- Previous results at all stages of undergraduate study are the best success predictors for follow on assessment
- First-year students tend to overrate their knowledge and abilities

Factors impacting on performance and persistence
- Performance and persistence is multi-faceted. Non-completion is due to a blend of factors including student characteristics, external pressures and institution related factors.
- Institution and programme choice are key determining factors
- 1st generation students tend to have unclear expectations of higher education which are often not met
- Access to teaching staff and feedback on progress are important motivators
- Support services are often beneficial to those that participate although most students who need the supports do not avail of them
- Finance is not a major factor as anticipated
- The impact of paid part-time work is not always negative
- Little concrete data on relationship between campus residence and grades

Support for first-year
- There is much literature identifying good practice for student supports and integrated interventions
- Induction is important but should not overload students with unnecessary information. There is strong support for a staged induction process
- Learning skills development is best achieved when embedded in curriculum
- Students need support in adapting to university life and becoming autonomous learners
- Friendship and social integration benefits the student experience
- Integration and supportive access to faculty teaching staff and resources greatly improves student adjustment
- Self efficacy, goal orientation and family support are all important in supporting first-year students

Learning and teaching
- Learning behaviour and cognitive growth are influenced by the first-year experience, students expectations, approaches to learning and teaching styles
- First-year students tend to adopt surface learning approaches
- Students need help in becoming autonomous learners, learning communities can be helpful for this development
- Assessment is important, well planned, peer and online assessment formats can help learning but students and staff must have a shared understanding of the language of assessment

in terms of improving students' academic performance (Peat *et al.*, 2001; Harley *et al.*, 2007). Interestingly Ulriksen *et al.*, (2010), note that it is not clear whether the success of such supports is related to the content provided or the increased interaction with classes and faculty thus aiding the integration into the university culture. Lovatt *et al.*, (2007) investigated students' engagement with learning supports (an online virtual learning environment and a drop-in science clinic) in undergraduate science and found that students' who availed of the learning supports provided performed better in their examinations. However, very few students engaged with the supports consistently during the modules, and those that most needed the supports only tended to access them at the examination periods when it was already too late. This finding is supported in Harvey *et al.*, (2006) summation that most students who need these supports don't avail of them.

Harvey *et al.*, (2006) and Ulriksen *et al.*, (2010) conclude that the relationship between the student and the institution is of paramount importance and that creation of a more student focused learning environment that increases interaction and engagement between students and academics, which builds upon students strengths as well as helping them to adapt to university, will lead to an ease of transition issues, greater retention and ultimately improved learning. Harvey *et al.*, (2006) summates that there are a variety of first year experiences but all have two defining features *i.e.* (1) the transition and adjustment period and (2) the mass experience of being a first-year, where students' tend not to be seen as individuals and are often instructed rather than having their learning facilitated. He notes that performance determining factors are very difficult to identify due to the personal nature of students engagement and that much of the good practice presented in the literature focuses on providing for students deficiencies rather than identifying their learning requirements and building on their strengths.

Transition into third-level science

The discussion thus far has primarily focused on the general cross-disciplinary experience of students' entry into university. The experience of science undergraduate students is now considered. Science and technology programmes in university have also seen an increase in absolute numbers though there has been a decrease in the relative share of numbers in the physical and mathematical sciences (OECD 2008, p. 23). OECD reports have highlighted transition difficulties for students entering into university science programmes; they note that within the OECD countries science is amongst the discipline with the highest dropout rates (OECD 2008 p. 74). These issues are of great concern for the science education community and thus there have been explorations into the first-year undergraduate science experience and numerous studies evaluating and proposing changes in pedagogical approaches to address worries regarding student interest and retention (Byers and Eilks 2009). In terms of student retention, Ulriksen *et al.*, (2010) proposes the question whether retention should be considered a matter of individual adaptation or institutional change; is retention

linked to deficient students who are unable to integrate into the university culture or is it a problem of the institutions' failure to meet the needs, knowledge and expectations of its students? Students' ability to identify with the university and curriculum culture is discussed by Ulriksen as an important factor impacting social and academic integration. This is particularly emphasised in relation to the science, technology and mathematics (STM) field. It is suggested that the way in which science curriculums are presented can alienate some cultures and genders as they find it difficult to identify with the portrayal of the field as a subject and a career. He also discusses work by Seymour (2002) who suggests that many responses to integration tend to focus on changing the student rather than the institution or discipline as it is deemed that changes to the latter would be detrimental to the quality of the programmes.

Student learning conceptualisations

In this section, student learning conceptualisations and related features are discussed to inform the reader of literature relating to student-centred factors influencing the transition into third level science. There are many conceptualisations of student learning (Richardson, 2000; Vermunt, 2005) including theories of student motivation, students' perspectives on learning and teaching and students' approaches to learning. Entwistle (2003) indicates that there are interlinking interactions between these factors that contribute to the quality of student learning (Fig. 1).

These factors can be divided into student and teaching factors though both influence each other. Student-centred factors including approaches to learning, motivations, preparedness for university and expectations of university were investigated. An overview of these is presented and discussed in the context of this study.

Student motivation and approaches to learning

'*Motivation is a concept which has been used by both psychologists and educationists to explain differences among learners in the amount of effort they put into their learning*' (Entwistle, 1987). A broad view of motivation categorises it into two types dependent on the source of the driving force, *i.e.* intrinsic motivation where there is an inherent (personal) desire or interest in a task while extrinsic motivation relates to situations where external factors create the driving force for doing a task. There are many perspectives on motivation including behaviourist, humanistic and social cognitive. In this study motivation is considered as intrinsic, extrinsic and amotivation (lack of any motivation) (Deci and Ryan, 2000).

Students' motivation for learning is influenced by numerous factors *e.g.* previous learning experiences, self-efficacy, interest, perceived value and expectation of success *etc.* There are definite links between student motivation and the approach they adapt to their learning. Marton and Säljö (1976a) observed that the processes students used to achieve learning were important factors in determining the outcomes achieved; they were the first to introduce the terms 'deep approach' and 'surface approach' where an approach to learning refers to the processes students adopt when learning.

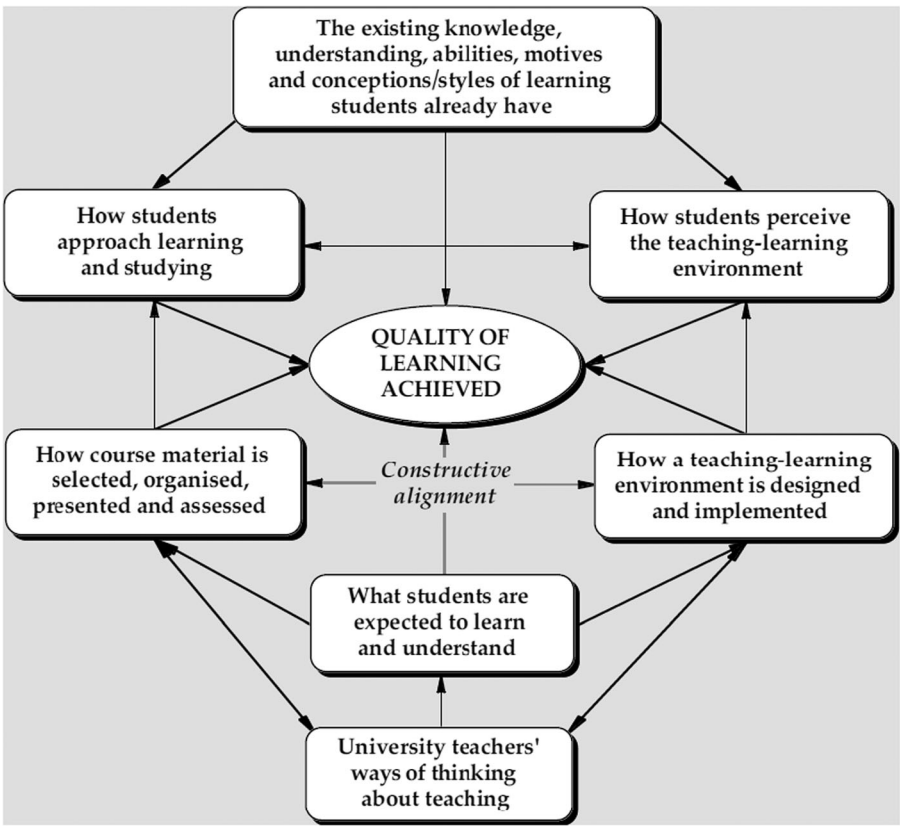

Fig. 1 Conceptualisation of factors influencing student learning from Entwistle (2003).

Marton and Säljö (1976b) carried out an investigation of students' learning processes when reading a given text. They noted that the 'approach' that students took in relation to the task influenced the outcomes of the task, and also that the outcomes were influenced by students conceptions of a task. It was found that students had differing perceptions of what was expected from them and that these expectations influenced how they tackled the task and the subsequent outcome achieved. '*There are two different aspects to an approach to learning. One is concerned with whether the student is searching for meaning or not when engaging with a learning task*; *the second is concerned with the way in which the student organises the task*' (Ramsden, 1992). The first aspect of the approach is subdivided into deep and surface approaches. Ramsden (1992) distinguishes the two as learning for real understanding (deep) *versus* imitation (surface). A deep approach refers to active engagement with a task in order to obtain meaning, *i.e.* when students intend to relate with the task in a manner that will allow them to understand the facts of the task in relation to real world concepts. A deep-approach leads to long-term learning and in-depth understanding. Marton *et al.*, (1992) state that a deep approach ''*is the best*, *indeed the only*, *way to understand learning materials*''. A surface approach, on the other hand, refers to students' obtaining information in a random pattern for short-term recall and is comparable to rote learning (Johnstone, 1997). It has been referred to as ''*a paralysis of thought*'' and as an approach that is ''*uniformly disastrous for learning*'', that leads to an inability to relate knowledge to real world situations. Table 2 gives a detailed comparison of the attributes of both approaches (Ramsden, 1992).

The further aspect of an approach to learning examines the holistic and atomistic nature of learning and deals with how the learner organises learning material (Pask, 1976). A holistic approach is one in which the student examines the material in full and interrelates all of the material, whereas with the atomistic approach, material in accessed in a piecemeal fashion. In reality the two aspects of the approaches are interrelated and thus the deep-holistic and surface-atomistic are often and will be referred to as deep and surface approaches respectively throughout this text. Ramsden (1981) later introduced a third approach, called the strategic approach. In this approach the focus is obtaining the highest grades possible. It is similar to the 'achieving' dimension identified by Biggs (1979). Students' adopting strategic approaches tend to focus on time management, organising their study, monitoring the effectiveness of their study and their achievements. However, as Biggs (1979) notes, this may correlate with good grades but it does not necessarily lead to long-term retention.

Approaches to learning are very often misunderstood (Ramsden, 1992). It is commonly assumed that approaches are characteristic of an individual and their innate make-up, thereby implying that the characteristics of the student determine the approach taken. Indeed approaches are not related to the characteristics of students, that is to say that all students, regardless of their ability, can adopt a deep, strategic or a surface approach. Indeed students can take different approaches depending on the particular task and the environment surrounding the task, thus the approach is more a response to the learning and/or teaching environment. It is governed by the students' perception and previous knowledge of the task. The environment surrounding the task relates to such issues as task content, task perception, perceived expectations, task assessment, task delivery, task engagement process, anxiety and even departmental perceptions (Entwistle, 2007). An acknowledgement and understanding of the various influences on learning approaches is essential in the provision of suitable learning environments for students, ''*In trying to change approaches*, *we are not trying to change students*, *but to change the students' experiences*, *perceptions*, *or conceptions of something*'' (Ramsden, 1992).

Expectations, perceptions and preparedness for first-year university

It was previously discussed that there are many challenges relating to student transition into university. Student dropout and underperformance at university can be related to incorrect perceptions and expectations of university (Tinto, 1994). Yorke, (2000) notes that there appears to be a mismatch between students' expectations of the university learning environment and the reality experienced and also that some students are ill-prepared to adjust to university study. Ozga and Sukhnandan (1998) report that ''*students' perceptions of higher education tended to revolve around stereotypical assumptions such as they*

Table 2 Attributes of deep and surface approaches to learning adapted from Ramsden (1992)

Deep approach (*Intention to understand*)
Focus on 'what is signified' (*e.g.* the author's argument, or the concepts applicable to solving the problem).
Relate previous knowledge to new knowledge.
Relate knowledge from different courses.
Relate theoretical ideas to everyday experience.
Relate and distinguish evidence and argument.
Organise and structure content into a coherent whole.
Internal emphasis: 'A window through which aspects of reality become visible, and more intelligible'

Surface approach (*Intention only to complete task requirements*)
Focus on 'the signs' (*e.g.* the words and sentences of the text, or unthinkingly on the formula needed to solve the problem).
Focus on unrelated parts of the task.
Memorise information for assessments.
Associate facts and concepts unreflectively.
Fail to distinguish principles from examples.
Treat the task as an external imposition.
External emphasis: demands of assessments, knowledge cut off from everyday reality.

assumed moderate academic demands compared to A-level courses and the 'extremely exciting' social life''. Studies have found that some students expressed low expectations of academic work commitments at university (Ozga and Sukhnandan, 1998; Lowe and Cooke, 2003; Byrne and Flood, 2005) and that students were unprepared for the different teaching environments in university such as large class sizes and lecture format (Yorke, 2000). Byrne and Flood (2005) found that students indicate that they are prepared for working independently but that this appears to be the biggest challenge for students. She notes that students struggle with the lack of monitoring and control, which they have been used to at second level. Cook and Leckey (1999) found that students have poor study techniques when starting university especially in the areas of time management, reading around lecture material, note taking, asking questions in large groups, and working in teams. Cook reports that students' study habits from school persist during first-year university and that they prefer teaching styles similar to those experienced in second level. Interestingly Jansen and van der Meer (2011) found that in a cross-national study of students' perceived preparedness for university that there were remarkable similarities in spite of the varied 2nd level experiences. They infer that there would be greater benefit from using pedagogical practices that help students advance their academic skills rather than demanding 2nd level schools prepare students better.

Aim of this study

Whilst there are valuable studies that have investigated external factors affecting the student transition into university science programmes dealing with issues such as distance, travel time, socio-economic background *etc.* and those that look at success predicting factors (Seery, 2009; Potgieter *et al.*, 2010), there are few within the science education literature that report on internal student factors beyond entry grades or these mentioned above. There are also very few that report on transition factors which academic staff have power to influence.

In the previous section, student-centred factors that are reported to influence learning at undergraduate level have been discussed. The aim of this study was to determine if a profile of the 'student-on-entry' to first year undergraduate university could be developed within the context of factors including motivation, approaches to learning, expectations and perceptions of university. To this end a profile of the science 'student-on-entry' to university has been determined. In the next section the methodology used to investigate this profile is discussed.

Methodology

In this section the data sample, research tools, data analysis process and data collection timeline are presented.

Data sample

The study was carried out in the authors' university where the academic year is based on two 16-week semesters. There are approximately 180 students in total enrolled in a variety of science degree programmes such as Biotechnology, Chemical and Pharmaceutical Science, Environmental Science, Analytical Science, Genetics and Cell Biology and Science Education. These students take common first year chemistry modules (lectures and laboratories). They are a heterogeneous group in terms of previous chemistry experience, interest in chemistry, age, gender, programme choice and university entry points. In this paper the abbreviations 'PC' and 'NC' will be used where PC refers to students with prior second-level (pre-university) chemistry experience and NC refers to students without this chemistry experience.

Research Tool 1 – approaches to learning inventory

A variety of inventories have been developed internationally. In Australia, Biggs (1979) developed the 'Study Process Questionnaire' (SPQ); in the U.S.A, Schmeck *et al.*, (1991) developed the Inventory of Learning Processes (ILP); in the Netherlands, Vermunt (2005) developed the Inventory of Learning Styles (ILS) and in the U.K. the Approaches and Study Skills Inventory for Students (ASSIST) (Entwistle *et al.*, 2000), was developed. In this study, ASSIST was used to measure students' approaches to learning.

This inventory determines students' approaches by analysing their responses to 52 Likert scale statements corresponding to 13 different subscales. The subscales relate to each approach as shown in Fig. 2. It can be seen that the subscales reflect the attributes of each approach. The deep approach is broken down into four subscales; namely, seeking meaning, relating ideas, using evidence and interest in ideas. The strategic approach is broken into five subscales; *i.e.* organised studying, time management, alertness to assessment demands, achieving and monitoring effectiveness, while the surface approach is split into four sub-scales; *i.e.* lack of purpose, unrelated memorising, syllabus-boundness and fear of failure. Entwistle (1997) notes that the first-three subscales in each approach are most consistently related, and that the subsequent subscales can vary in their relationships depending on the sample being evaluated. For example, in the strategic approach, the subscales, ''organised study'', ''time management'' and ''alertness to assessment demands'' are consistently related to the strategic approach, however, the subscale ''achieving'' and ''monitoring effectiveness'' is not always related to this approach.

Research Tool 2 – motivation, preparedness and expectations tool

The Motivation, Preparedness and Expectations (MPE) tool was used to determine (a) the main factors that influenced students to attend university; (b) students' expectations and intentions towards university life and study and (c) how prepared students feel for the transition to university. The development of the MPE was based on two surveys, (1) the Academic Motivational Scale (AMS) developed by Vallerand *et al.*, (1992) which investigated students' reasons for attending university and (2) by Byrne and Flood (2005) who investigated university business students' motives, expectations and preparedness for university. The two sections of the tool are discussed below.

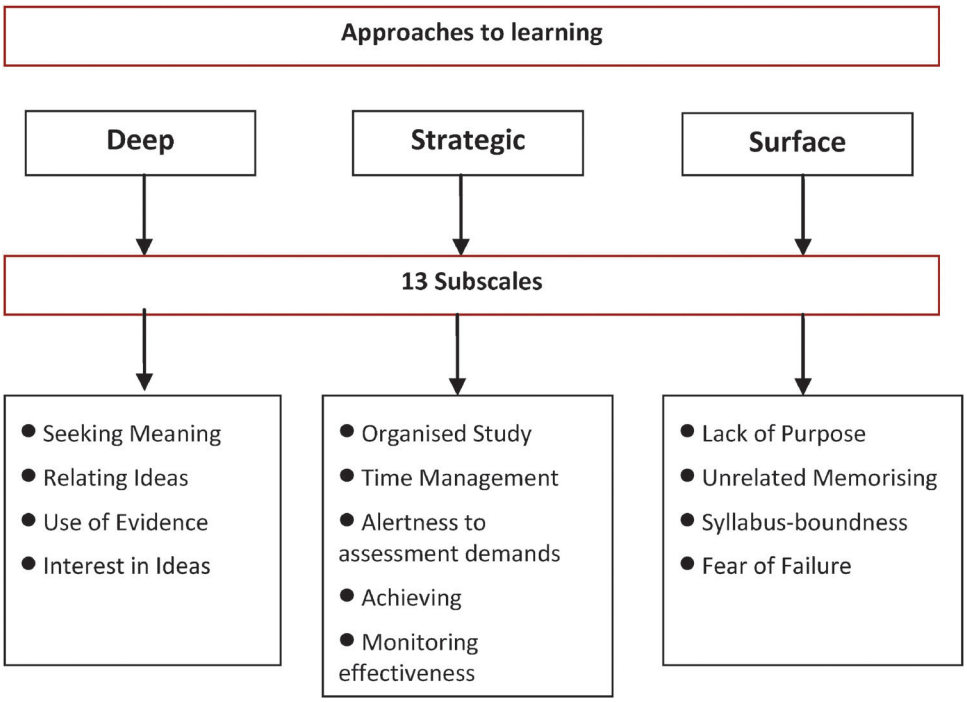

Fig. 2 Outline of ASSIST, adapted from Entwistle (2000).

Motivation

Four questions from the MPE tool were specifically related to students' motivations for attending university. The first three inquired whether students were enrolled on their first preference course, whether they had enjoyed chemistry at second level and what influenced them to attend university. The fourth question contained 13 statements relating to motivations for attending university; students were asked to indicate their level of agreement to these statements on a Likert scale. These questions were categorised in-line with the AMS categorisations, into three types of motivation; intrinsic, extrinsic and amotivation.

Expectations and preparedness for university

The remainder of the MPE tool contains questions relating to students' expectations and preparedness for university. Aspects of this were also developed from the survey used by Byrne and Flood (2005). The expectation questions inquired about students' intentions towards their study *e.g.* the number of hours they intend to study, whether they are going to have a part-time job, the grade they are aiming to achieve and the topics they hope to cover. The preparedness question consists of 14 statements to which students indicated their response on a Likert scale. These statements related to four general categories (1) academic expectation (AE); (2) learner autonomy (LA); (3) engagement (EN) and (4) Study and ICT Skills (SS).

Data analysis

Analysis was carried out on the data compiled using the ASSIST and MPE tools. Factor Analysis tests were run to determine the construct validity of the ASSIST tool. Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity were run to ensure factor analysis was viable. The KMO test measures 'sampling adequacy' to check whether the data can be used for factor analysis. KMO values above 0.5 justify the use of factor analysis. The Bartlett's Test of Sphericity determines whether there are correlations between the items on the inventory. When this test is significant it indicates that factor analysis can be used. KMO values obtained were above the 0.5 cut off point and Bartlett's Test of Sphericity was significant for all data analysed. 'Principle factor analysis' was the factor analysis test used in this work. The outputs of Factor Analysis tests were comparable to the ETL project (Entwistle *et al.*, 2000) and a previous study (Kelly, 2005).

Cronbach's alpha tests were run to check the internal reliability of the ASSIST and MPE tools. Cronbach's alpha measures inter-item correlations and alpha values above '0.7' indicate good reliability. In the case of ASSIST, reliability checks were carried out for each approach (Table 3) and for all of the individual subscales. Some of the Cronbach's alpha values obtained for the subscales in this study were not above '0.7'.

Table 3 Comparison of Cronbach's alpha values for main approaches to learning scales

Scale	ETL	Study
Deep	0.84	0.81
Strategic	0.80	0.86
Surface	0.87	0.78

ETL: Enhancing Teaching and Learning Project (Entwistle *et al.*, 2000).
Study: Study being reported in this paper.

However, they are comparable with other studies using ASSIST (Stiernborg *et al.*, 1997; Duff and Duffy, 2002; Kelly, 2005). Since the values recorded are comparable with these studies and the main approaches scales are above '0.7', it was deemed suitable to use the inventory in this research. Paired and independent *t*-tests were used to analyse the ASSIST data.

The Cronbach's alpha result for the motivation Likert statements was 0.732 and a value of 0.817 was recorded for the preparedness Likert statements signifying good internal reliability for both tools.

For all other statistical tests used, values of p less than 0.01 indicate a 99% significant finding and p values less than 0.05 indicate a 95% significant finding. Mode values are given for Likert items. The mode value is also accompanied by the percentage responses given by students to give a better indication of the spread of students' responses. For ease of presentation some of the percentages are grouped *e.g.* the responses to 'strongly agree' and 'agree' are grouped together, however none of the Likert data were grouped for the purpose of data analysis.

Data collection and timeline

Data relating to students' profile on entry to university were collected during the first weeks of their university life. The student profile focused on students' motivations, preparedness for university, expectations of university including anticipated interaction with learning supports, approaches to learning, gender, previous chemistry experience and entry points. Data were collected during lecture and laboratory sessions. Surveys were completed voluntarily. Identifiers were included on all surveys for the purpose of matching students' responses. In cases where identifiers were not completed, that data were used where appropriate. The response rate for data obtained is given in Table 4.

Results and discussion

Key findings from the students' approaches to learning and their motivation, preparedness and expectations of university are now discussed.

Approaches to learning

Student responses to ASSIST on entry to university highlighted that they adopt more deep and strategic approaches to learning compared to a surface approach (Table 5). However, there are no significant differences observed between their preference between deep and strategic approaches at the start of their university studies.

Table 4 Outline of data collection for study; all data were collected on entry to university

		Gender[a]		2nd Level Chemistry[a]	
Collection tools	n	Male	Female	PC	NC
A	164	70	64	76	81
MPE	162	67	95	72	87

A = ASSIST Inventory, MPE = Motivation, Preparedness and Expectations survey. [a] Some students did not complete this identifier data.

Table 5 Students' approaches to learning at entry to university

Paired-Approach	Diff	σ	t	df	p
Deep-Strategic	0.13	2.06	0.79	147	0.428
Deep-Surface	2.14	3.31	7.85	146	0.000[a]
Strategic-Surface	1.94	3.41	6.99	150	0.000[a]

[a] Indicate significant difference between approaches.

This finding agrees with a previous study (Kelly 2005). However, they are in contrast to those noted in Table 1, where it's indicated students' tend to adopt surface approaches. However, since the ASSIST data were collected during the initial stages of university study it is suggested that these findings may represent students' approaches based on their previous learning experiences and/or their expectations for study at university. The 13 subscales, which contribute to the overall approaches, were investigated in relation to students' approaches to learning as they start university (Table 6). It is observed that certain subscales are scored higher than others. In terms of a deep approach, students rated 'use of evidence' the highest and 'interest in ideas' the lowest. In the strategic approach subscales, 'monitoring effectiveness' was scored high whilst 'organised studying' was rated particularly low followed closely by 'time management'. Students rated the surface subscale 'fear of failure' particularly high (mean = 14.3), though they rated 'lack of purpose' quite low (mean = 8.7), indeed it was the lowest scored subscale.

The data were further analysed in terms of gender and students' previous chemistry experience. Gender differences were not significant in relation to students' overall approaches to learning. However, some differences were observed when the subscales were investigated. Female students consistently scored higher on 'organised study' (p = 0.030) and 'fear of failure' (p = 0.002). This would perhaps indicate that they are better at organising themselves in relation to their study and that a fear of failure is a more dominant motive for their study compared to their male colleagues. NC students scored the surface approach significantly higher than PC students (p = 0.002). The subscales 'lack of purpose' (p = 0.006), 'unrelated memorising' (p = 0.000)

Table 6 Average score for each ASSIST subscale

Approach	Subscales	Mean[a]
Deep	Seeking meaning	14.2
	Relating ideas	14.1
	Use of evidence	**15.0**
	Interest in ideas	13.9
Strategic	**Organised study**	**12.7**
	Time management	**13.1**
	Alertness to assessment demands	14.8
	Achieving	14.8
	Monitoring effectiveness	15.6
Surface	Lack of purpose	8.7
	Unrelated memorising	12.6
	Syllabus-boundness	13.3
	Fear of failure	**14.3**

[a] This is the mean value recorded out of a possible total of 20 for each subscale.

Table 7 Student motivation for attending university, % agreement with each statement

	n	Strongly agree/agree	Somewhat / not sure	Very weakly / weakly agree	Mode[a]	Category
I hope the things I learn will help me to **develop as a person** and **broaden my horizons**	160	83	15	2	5	I
I hope the whole experience here will make me **more independent and self-confident**	160	88	10	2	5	I
I want to **study the subject in depth** by taking **interesting and stimulating** courses	158	74	23	3	5	I
I want to learn things, which might **let me help people, and/or make a difference in the world**	159	77	18	5	5	I
I'm focused on the opportunities here for an **active social life and/or sport**	158	68	24	8	5	I/E
I want to develop **knowledge and skills** I can use in a **career**	160	99	1		5	E
I mainly **need the qualification** to enable me **to get a good job** when I finish	160	73	18	9	5	E
Progression to university is what others **expected of me**	159	54	14	32	5	E
I want an **opportunity to prove** to myself or to other people **what I can do**	159	57	23	20	4/5[b]	E
Coming to university affords me **three more years to decide what I really want to do**	160	34	28	38	3	E/A
Having done well in school, going to university **was the natural thing to do**	159	76	14	10	5	A
All **my friends were going to university**	160	22	15	63	1	A
When I look back, **I sometimes wonder why I ever decided to come here**	159	7	11	82	1	A

[a] 5 = strongly agree. [b] Equal amount of responses were recorded for strongly agree and agree. I = Intrinsic, E = Extrinsic, A = Amotivation.

and 'syllabus-boundness' ($p = 0.045$) were all rated higher by NC students. However, NC students still indicated a higher preference for deep and strategic approaches over a surface approach.

Motivation

'Interest in subject' was noted as the primary influence by the majority (62%) of students for attending university, followed by 'career' (22%). Family, school and friends were only chosen as the primary influence for attending university by less than 10% of those sampled. Table 7 highlights student responses to the motivation Likert statements on the MPE survey. Students' indicated their highest overall level of agreement towards the 'intrinsic' motivation statements. They appeared to be focused on learning that would help them to become more independent (88%), develop as a person (83%), allow them to make a difference in the world (77%) and they wanted to study interesting and stimulating content (74%). Student response to the categorised 'extrinsic' statement, 'I want to develop knowledge and skills I can use in a career' received the highest individual agreement (99%), but only 77% of students agreed to the statement 'I mainly need the qualification to get a job'. It appears that, though a job was important to students, learning knowledge and skills heavily influenced their attendance at university. This appears to supports the previous findings that intrinsic motivators and interest in subject are predominant factors in their decision to attend university.

Furthermore there were lesser levels of agreement observed to the other 'extrinsic' statements such as 'Progression to university is what others expected of me' and 'I want an opportunity to prove to myself or to other people what I can do', highlighting that peer or family pressure was not a major influence on students' attendance at university. Student responses indicated very low levels of agreement to 'amotivation' categories, with the exception of the statement, 'having done well in school, going to university was the natural thing to do'. 76% of students agreed with this statement compared to an average of 15% agreement to the other two 'amotive' statements. Finally, only 34% agreed to the statement 'coming to university affords me three more years to decide what I really want to do' perhaps indicating that students were fairly clear on the career they wished to pursue. There were no differences in the findings when males were compared to females, however there were some differences observed based on students prior chemistry experience. Significantly more PC students ($p = 0.028$) were currently studying their 1st choice course based on their university application. This may explain why NC students appeared less motivated to 'studying the subject in depth and taking interesting and stimulating courses', ($p = 0.018$). They also indicated a higher agreement to two of the amotive categorised statements; 'when I look back I sometimes wonder why I ever decided to come here' ($p = 0.009$) and 'all of my friends were going to university' ($p = 0.019$). However, it should be noted that, while there were significant differences between PC and NC students observed in relation to these statements, amotivation statements still had the least support on all students' reasoning for attending university.

Preparedness

Students' responses regarding their perceived preparedness for university are given in Table 8. They are divided into four loose groupings namely, learner autonomy (LA), willingness to engage (EN), study skills including ICT (SS) and academic expectations (AE). Students' generally indicated high levels of agreement to the statements relating to these groupings.

Table 8 Students' preparedness for university study, % agreement with each statement

Statement	*n*	Strongly agree/agree	Somewhat / not sure	Very weakly / weakly agree	Mode[a]	Category
I know what is **expected of me academically** in university	158	64	28	8	4	AE
I am able to **work independently without much direction** from a teacher	158	48	41	11	3	LA
I am able to **initiate my own study** activities	155	68	26	6	4	LA
I am able to **plan my study in a time effective manner** to meet all my deadlines	157	56	31	13	4	LA
I am able to **take responsibility** for my own learning	158	80	18	2	4	LA
I am able to **evaluate my own progress**	157	59	36	5	4	LA
I am able to **organise my own life** generally	155	77	21	2	4	LA
I am comfortable **working in groups**	156	89	10	1	5	EN
I am willing to **participate in class**	157	90	9	1	5	EN
I am willing to **ask for help** from my lectures/tutors	156	77	19	4	5	EN
I am confident in **planning and making oral presentations**	157	32	36	32	3	SS
I am confident about my ability to **complete written assignments**	157	74	23	3	4	SS
I am confident about my **ability to use a computer**	156	72	19	9	5	SS
I can use **internet and other resources to gain information**	157	89	10	1	5	SS

AE = Academic expectation, LA = Learner autonomy, EN = willingness to engage, SS = Study and ICT skills. [a] 5 = strongly agree.

They appeared willing to engage with their courses where, 90% of students were willing to participate in class, 77% were willing to ask for help from lectures/tutors and 89% were comfortable when working in groups. Students indicated a confidence in using the Internet to access information and resources (89%) but were a little less confident in their general computer skills (72%). It was also found that there was a general lack of confidence in terms of planning and making oral presentations. This somewhat reflects that 'organised study' and 'time management' were the least rated strategic subscales on the ASSIST inventory.

There are some seemingly conflicting responses regarding the 'learner autonomy' statements. Students' (80%) believed they were able to take responsibility for their learning and indeed 77% felt they could organise their own lives generally; however, they were less confident regarding their ability to work without teacher direction (48%), ability to plan their study and meet deadlines (56%) and to evaluate their own progress (59%). These learning responsibilities are key skills that are required for university study and highlight an area that needs to be addressed during the initial stages of university programmes.

Students' prior chemistry experiences appeared to have no influence on their perception of preparedness for university study. The gender analysis only identified one difference in terms of their preparedness for university where female students rated themselves significantly less confident in terms of planning and making oral presentations ($p = 0.002$) than their male colleagues.

Expectations

Findings show that 64% of students believed they knew what was expected of them academically at university and 88% of students noted that they are aiming to achieve a high honours grade, though 45% indicated they would be happy with a low honours or pass mark. Male students were aiming to get higher grades than female students ($p = 0.039$) whilst NC students were aiming for ($p = 0.042$) and noted they would be happier with ($p = 0.001$) a lower grade in chemistry than PC students. Student responses highlight that in addition to their required contact hours, students intended to study up to 11 h each week, with four of these hours been directed towards chemistry. The majority of students (80%) also expected to have a part time job, working an average of 13 h each week with male students' indicating that they intended to work more hours than their female colleagues ($p = 0.009$).

Summary of main findings

The purpose of this study was to learn about the students' who enter first year science at university. It was intended to use this information to identify student strengths and motivations for university entry so that they could be used as possible starting places for academics to make the first-year experience more student-centred and to help ease the transition for students. The data collected has shown a quite positive picture of students' intentions towards science study. Intrinsic motivators and subject interest were found to be prominent factors influencing students' entry to university. These highlight a desire by the students to 'develop knowledge and skills', to take 'interesting and stimulating courses', a desire to become more independent and a want to make a difference in the world.

Students indicated a preference for deep and strategic approaches to their learning compared to surface approaches. They ranked subscales such as 'use of evidence', 'monitoring effectiveness, 'achieving', 'relating ideas' and 'seeking meaning' as some of the highest reflecting their intrinsic motivation for studying undergraduate science.

While caution needs to be paid to students self-perceptions of their abilities as discussed earlier for the most part, they perceive themselves reasonably prepared for university study and indicate a willingness to participate and interact with academic staff. However, while students indicate they are able to take responsibility for their learning and to organise their own lives there is concern that they are somewhat less confident in terms of their ability to initiate and organise their study, to meet deadlines and to work without direction from a teacher. It seems students' are willing to engage in autonomous

learning but need assistance in becoming autonomous learners. These are key findings, which identify areas where academics can build upon students' strengths and expectations of university study. In the next section these will be discussed in the context of identifying possible areas for improving the first year transition into university science.

Implications for teaching

It is suggested that the knowledge of these findings can be beneficial in designing a student-centred first year experience. In terms of willingness to interact, participate in class and use methods such as group work, the findings are quite positive. It would hold that this is an opportunity that academics and teachers need to build upon. Students are eager to study science; they want to take interesting and stimulating courses. The challenge is then put on the academics to find ways to make the curriculum content relevant to students and to show them how it relates to future possible careers. This opens the door to modifying the lecture experiences where students often sit passively, to include teaching experiences where they interact more with peers, tutors and academics. Inviting postgraduate students or other staff member to speak at the introduction or end of a lecture about their research on a weekly basis could help highlight the benefits of studying science and help integrate students into the culture of the university. Using Classroom response systems (Koenig 2010) to encourage questions and interaction in large lecture theatres could be investigated. Indeed the challenges of students working independently appear to indicate that methods such as didactic large lecture teaching may not work for these students unless they are modified to make the learning more student-centred. Students need to be engaged at a more personal level. This could be done in a variety of ways including group activities in lectures, laboratory work, more use of teaching assistants, tutorial groups *etc.* It is proposed that through such activities and assessment for learning strategies, a more structured approach could be taken to the development of study skills by helping students learn to set personalised goals, identify their strengths and for development. It is thought that by incorporating such activities in the context of the curriculum, the problems associated with standalone study modules previously discussed can be avoided. It is suggested that by making learning intentions explicit students will see that academics are trying to help and facilitate both their study skills and conceptual development and indeed that they care for such matters.

In conclusion it is recommended that institutional responses to student transitions into science programs must identify and build upon students' strengths, expectations and motivations for entering university. It is recommended that the type of teaching students need at 1st year level is that which is often provided to those at third and fourth year level. This is probably because the numbers decrease at these stages. It is suggested if students are provided with the opportunities to develop self-assessment skills and to become autonomous learners earlier in their university careers more students may continue into the later years of study and indeed at these stages may require less personalised interaction. As Harvey *et al.*, (2006) notes the first year experiences needs to be considered in the context of a four-year programme. If this is done students can be provided with the type of teaching they need at the appropriate stages. However, to do this, students' strengths, motivations, expectations and perceptions must be ascertained as a start place to provide the appropriate experience.

Limitations of study and further research

It is noted that this study reports on one cohort entering a university at one period in time. Whilst the sample is large and the courses being taken are similar to international programmes it is not suggested that these findings are generalisable, though they do reflect many of the transition challenges as noted by Harvey *et al.*, (2006). The study also focuses on the entry stage to first year undergraduate study. Further research has been conducted to determine how this initial profile is maintained throughout the first year experience. Analysis has been completed to determine how this student-centred profile correlates with students' performance in their terminal examinations. Further papers will show how student-centred interventions such as small group teaching in laboratories can be developed and examined in the context of their role in influencing the student transition into undergraduate science.

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