Abstract
Despite continuous growth in the number of positions in Australia’s Information Technology (IT) industry since 2015, only half of Australia’s IT graduates go on to work in IT positions. A much-debated challenge for graduates is that the transition to work is complex and often demands several attempts. Less discussed is why school students choose to study IT at university and whether these motivational factors inform their career choice. The motivation to study at university has many potential influences including social factors, prior experience, self-perceptions, intrinsic or personal utility values, or simply the prospect of a good salary. Students’ choice of university major has similar influences; however, many learners select their major and enter university without having thought about possible career pathways. As such, without appropriate support during their time at university, students may not translate interest and motivation into career identity or commitment, and they may not develop realistic career goals or job-seeking strategies. To understand the antecedents to career interest, this study investigated the choice of major and career aspirations of undergraduate IT students at an Australian university. The two-year study engaged students in two phases of data collection. First, students completed an online self-assessment of study and career confidence, answering two open questions on why they chose to study IT and how long they intended to work in the discipline. Students then responded to a short online survey about their short- and longer-term career aspirations and prior experience. The results show that the motivation to study IT is based largely on intrinsic interest and enjoyment of IT rather than on external factors such as salary or job security. Most students reported broad career aspirations related to IT; however, students were unable to articulate what these careers might entail and they were unsure about the amount of time they would spend in the IT profession. The study concluded that understanding IT students’ motivation for study could inform career development learning activities through which students transform their interest into career choice and pre-professional identity.
Keywords  Information Technology · Higher education · Career Aspirations · Study Major

1 Introduction

Information Technology (IT), Information Communication Technology (ICT) and Computing are umbrella terms used to describe the broad professional area of IT (Deloitte, 2018; Palmer et al., 2018). According to the Digital Pulse report (Deloitte, 2020), the IT workforce in Australia increased 6.8% from 2018 to 2019; this is more than double the increase recorded in other areas of the labour market. Forward projections suggest continued growth in Australia: for example, from an IT workforce of 772,100 to one of 1,000,000 by the year 2027 (Deloitte, 2020). Although 93.8% of IT graduates reported labour workforce participation in 2019 (QILT, 2020), less than half of all 2019 vacancies were filled by people with an IT degree. The trend towards project-based, part-time, and hourly-based work is already evident in the Australian graduate data, which show that less graduates were working full time in 2019 than previously (FYA, 2021); QILT (2020). Towards mid-career (between 35 and 44 years of age), Palmer et al., (2018) found that only 30% of people who started their career in the IT profession remain in IT, suggesting that many professionals leave the sector or take other (non-technical) roles. The data suggest that an initial career choice to work in IT may not translate to career-wide engagement.

A career is a complex, personal and dynamic activity in which people engage for a significant part of their lives. A career is constructed through a complex mix of professional and personal processes and activities influenced by dynamic interactions between beliefs, behaviours, society and environment (Hall, 2002; Patton & McMahon, 2006). Many students come to university with a career interest or career aspiration, informed by their previous experience. During their time at university, students will ideally participate in experiences that align with and extend their emerging career identity. A contributing factor is that of directing deliberate attention towards an area of work that holds career interest. It is important that students add to their career thinking a realistic understanding of the labour market in which they would like to work. In developing this understanding with IT students, a number of dominant narratives need to be disrupted. A prime example is the assumption that students within science, technology, engineering and mathematics (STEM) disciplines are high-achieving students who prefer technical roles. In contrast, previous studies suggest that student who study IT aspire for a variety of roles in and outside of the discipline (e.g., McKenzie et al., 2017).

Many learners enter university without having engaged in career thinking. This limits their ability to make informed career choices or to engage intentionally in career development learning (CDL). Understanding students’ choice of major and emerging career aspirations has the potential to support their career decision-making and exploration. There is therefore a need to understand students’ motivations for study and career, particularly during the upper years of secondary school and the first year of university (Tsakissiris & Grant-Smith, 2021).
To understand the antecedents to career interest, the two-year study reported here examined the choice of major and career aspirations of undergraduate IT students at an Australian university. The article first reviews the literature and introduces the approach and theoretical framework. The results are presented thematically and then discussed. The article ends with practical implications for educators.

1.1 Understanding students’ choice of study major and career aspirations through the lens of social cognitive career theory

In line with social learning theories of career decision making (Mitchell & Krumboltz, 1990) and social cognitive career theory (SCCT) (Lent et al., 1994, 2000), there is broad agreement that career interest or motivation is socially constructed, with choice of university major often influenced by prior experience, self-perceptions, intrinsic or personal utility values. SCCT, a derivative of social cognitive theory (Bandura, 1986), is an established framework with which to characterise the career decision making of students. In SCCT, career interest is defined as the curiosity and positive emotion for constructing a career (Janz & Nichols, 2010). SCCT describes that people generate career interests by developing confidence in activities related to their interests (i.e., self-efficacy) with outcome expectations validated through expended effort Betz & Hackett, 1983; Johnson & Muse, 2017; Morrison, 2014; Lent et al., 1994, p. 87) emphasise that “the effects of learning experiences on future career behaviour are largely mediated cognitively … people differentially recall, weight, and integrate past performance into arriving at efficacy appraisals”. As such, SCCT emphasises both feedback and feed-forward mechanisms together with intra- and inter-personal, historical, and contemporaneous dimensions.

In previous studies exploring IT students career aspirations and career development plans, students’ lack of confidence or efficacy beliefs was identified as a key attribute assisting formation of career choice (McKenzie et al., 2015). Lent et al. (2008) found in their study of undergraduate computer science students that self-efficacy played a significant role to either directly or indirectly mediate outcome expectations, career supports or barriers, to form career interest and goals. The link to choice of major is made by Wigfield & Eccles (2000, p. 82), who write that “life-defining choices such as those linked to course enrolments, college majors, and occupational choice are influenced by the value individuals attach to the various achievement-related options they believe are available to them”.

Luse et al., (2014) found in their later study that interest and outcome expectation have a significant positive impact on students’ choice of major, yet noted variance in the motivator for choosing a major in IT. Mahadeo et al., (2020) found that interest informed students’ emerging identity as an IT professional, with predictors of career choice being efficacy beliefs, interest, and recognition or achievement in computing. However, the availability of career supports and barriers also influences the development of career interest and, subsequently, career choice (McKenzie et al., 2015). Overall, SCCT explains both pre-professional and career behaviours (Janz & Nichols, 2010) and provides a general predictive in understanding the interest and choice of STEM cohorts by both gender and race/ethnicity (Lent et al., 2018).
As a framework for understanding the aspects needed to build self-image, then, the social cognitive theories of Bandura provide a logical scaffold for research on students’ choice of study major and career aspirations. To understand motivation and interest, we adapted Lent et al., (1994) model of basic career interests and Richardson and Watt’s (2006) FITchoice model to highlight the cognitive and behavioural influences that impact students’ choice of major and career aspirations. Whereas Lent et al.’s (1994) model is designed to illustrate the development of career interest over time, we focused on sources of self-efficacy and outcome expectations to propose an adaptive ‘choice of major’ model (Fig. 1) that includes the aspects of emotional and pragmatic choice. Soria & Stebleton (2013) study of career decision making, using self-determination theory (SDT), concluded that the inclusion of students’ intrinsic and extrinsic motivations is valuable in both initial study decisions and in supporting students through the student lifecycle. A contributor to the model, and aligned with the need to disrupt the stereotypes attributed to STEM students, is that STEM majors are motivated by personal utility value such as meaningful work, task challenge and a positive work environment (Bennett et al., 2020; Watt et al., 2012) and by utility or

Fig. 1 Adaptive ‘choice of major’ model

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altruistic-type motivations (Wigfield & Eccles, 2000) such as making a social contribution or resolving environmental concerns.

As shown in Fig. 1, students’ pre-university career aspirations—the antecedents to students’ choice of major—are informed by socialisation influences such as family, friends, teachers and prior experiences (Bandura, 1986; Bright et al., 2005; Carduner et al., 2011; Lent et al., 2002). Students’ choice of major can be negatively influenced by social dissuasion and variously influenced by multiple internal and external influences.

To explore the factors that impact students’ choice of major and career aspirations, this two-year study asked three research questions designed to enhance understanding of what motivates undergraduate students to study IT:

1) How do undergraduate IT students choose their study major (antecedents)?
2) What are the immediate and long-term career aspirations of undergraduate IT students?
3) How do these choices and aspirations inform students’ career interests?

2 Approach

To understand students’ motivation to study IT, data was collected from students using two research instruments. Ethical clearance was obtained from the human research ethics committee from the first author’s institution.

2.1 Instruments

The first research instrument used in this study was an online self-assessment in which students responded to two open text questions:

Q1 How did you choose your major (discipline)?
Q2 How long do you intend to stay in your current chosen profession?’

Students were then invited to respond to a short online survey about their short- and longer-term career aspirations and prior experience. Students responded to two questions, repeated below. Both questions asked students to select their answer from a drop-down list with options based on roles defined by the Australian Government (2013) and the results of a previous study with IT students (McKenzie et al., 2017). Students could also select ‘other’ to provide an answer via free text.

Q3 What job do I want to get once I finish my degree?
Q4 What is my career goal long term?

In addition to these two questions, students responded to yes/no questions related to their prior work or work experience (e.g., internships) in IT.

2.2 Recruitment and sample

To avoid bias within a single student sample, the study was run with all online and on-campus students enrolled in the same IT subject and it was run in two consecutive years. The study engaged students enrolled in a second-year subject known as IT professional skills, a core subject in the IT degree program at Deakin University.
Students were invited to participate in the study by email. Students received information about the study, and they signed a consent form. Student anonymity was assured, and students were made aware that they could withdraw from the study at any time. Demographic variables included gender, age, and mode of enrolment (on campus or online).

Responses to the online self-assessment were received from 738 students from a total enrolment of 3,444, giving a response rate of 21.4%. 84% of students identified as male and 16% as female; no students identified as non-binary. 76.5% identified as on-campus students and the remainder attended university online or in mixed mode. 68% of students were aged between 18 and 24 years, 25% were aged 25 to 34 years, 4.5% were aged 35 to 44 years and 2.5% were aged 45 to 54 years. Fisher’s exact test was employed to determine whether the self-assessment instrument sample was representative of total enrolment. The exact, two-sided version of Fisher’s test was used to compare the demographics of the online self-assessment sample (n=738) with that of the IT student population (n=3,444); the test computes a significance (p) value for the observed proportions of the variable categories in each student group. There was no significant difference in mode of attendance (p>0.704); however, the test revealed a significant difference in gender between the respondent sample and the entire student cohort (p>0.137). The results should be viewed with a degree of caution as they are not representative of the student population in relation to gender.

The online survey of career aspirations and prior experience received 177 responses (5%). Of these, 75% identified as male and 24% as female. 2% were under 18 years of age, 70.5% were 18–24 years, 15.5% were 25–34 years, 5% were 35–44 years, 4% were 45–54 years, and 3% were aged 55–64 years. 58% of IT students in the sample came to university straight from high school and 42% came to university through an alternate pathway. 13% had completed an internship or work placement (paid or un-paid) prior to commencing their studies. Due to the lower response rate, the demographic information from the online survey of career aspirations and prior experience did not receive further analysis using Fishers Exact Test.

This qualitative study allowed students’ rich responses to be considered through the theoretical lens of SCCT. For research instrument one, student responses were coded using an a priori structure informed by the adaptive ‘choice of major’ model described in Fig. 1. Students’ choice of study major was coded to one or multiple motivations. For research instrument two, career aspirations and prior experience responses were grouped into similar categories using inductive analysis with a count analysis was applied to represent the final analysis. A dual coding process was conducted for both the a priori (Creswell, 2007) and inductive analysis across all themes.

### 3 Results

The following results combine the findings from the two data collection instruments to report students’ choice of study major and career aspirations.
3.1 Choice of study major

Asked why they chose their study major, the IT students overwhelmingly cited intrinsic motivations in the form of self-interest or enjoyment. The second most common motivation for choosing IT was voiced as positive job prospects, which is a personal utility value. Table 1 shows the count frequency of each motivation for students’ choice of study major, with categories drawn from the adaptive ‘choice of major’ model. As seen in Tables 1, many students reported more than one motivation for choosing to study IT: for example, “It interests me, lots of career paths and a financially stable career choice”. Each student response was therefore coded onto one or more categories, enabling intersectionality to be demonstrated.

A visual representation of the intersections between motivations was graphed using a modified scatter plot and is shown in Fig. 2. The scatter plot had point axis modified to represent the intersections between motivational factors. Each motivation is presented in Fig. 2 as a circle and is labelled with the relevant motivation short title.

| Motivation for IT students’ choice of major | Count | Alignment |
|--------------------------------------------|-------|-----------|
| Intrinsic: Interest/Enjoyment (IV1)         | 561   | IV3, PE, PU1, SI, SP1/2, SU1/2/3, TR1/2 |
| Personal Utility: Job prospects (PU1)       | 158   | IV1, PE, PU3, SP1, SU3/4, TD2, TR1/2 |
| Social Utility: Social contribution (SU3)    | 27    | None |
| Self-perceptions: Perceived ability (SP1)   | 26    | IV1/3, PU1 |
| Socialisation Influences: Prior experiences (PE) | 24 | IV1, PU1/3 |
| Intrinsic: Meaningful work (IV3)            | 23    | IV1, SP1/2 |
| Personal Utility: Transferable skills (PU3) | 11    | IV1, PE, PU1 |
| Socialisation Influences: Including family (SI) | 10 | IV1, SD |
| Task Return: High salary (TR2)              | 9     | IV1, PU1 |
| Self-perceptions: Manageable coursework (SP2) | 7   | IV1/3 |
| Task Return: High social status (TR1)       | 6     | IV1, PU1 |
| Fall-back program or career path            | 4     | None |
| Social Utility: Social equity (SU2)         | 4     | IV1 |
| Diffusion or absence (choice not considered) | 3   | None |
| Social Utility: Future impact (SU1)         | 3     | IV1 |
| Task Demand: Expert career (TD1)            | 3     | None |
| Task Demand: Demanding career (TD2)         | 2     | PU1 |
| Socialisation Influences: Social dissuasion (SD) | 1 | SI |
Fig. 2 Representation of motivators for choice of study major of IT students (weighted)

(as shown in Table 1). Overlapping circles in Fig. 2 show how motivators for choice

| Table 2 | Anticipated time in profession reported by IT students |
|---------|------------------------------------------------------|
| **Whole of career** |                                      |
| 20+ years | 6.23 |
| A long time - unknown length - Until senior role | 25.22 |
| “Entire career”; “Until retirement” | 26.41 |
| Total (whole of career) | 57.86 |
| **Part of career** |                                      |
| Less than 1 year | 1.93 |
| 1 to 3 years | 9.50 |
| 4 to 5 years | 5.79 |
| 6 to 10 years | 3.71 |
| 10 to 20 years | 9.79 |
| Total (part of career) | 30.72 |
| **No time or no decision** |                                      |
| No intension to work in IT | 0.89 |
| Unsure or doubt | 10.53 |
| Total (no time or no decision) | 11.42 |
of study are related. The size of the circle reflects the frequency count or weight. As seen, intrinsic motivation represents the largest circle with 561 points (Table 1).

Shown in Fig. 2, most of the motivators for choice of study major intersect with the intrinsic factor of interest/enjoyment (IV1). The exceptions relate to students who chose to study IT on the basis that it is an expert career (Task Demand 1 - TD1) or that it will enable them to make a social contribution (Social Utility – SU3). Not surprisingly, interest was not a factor for students who did not consider IT to be their first choice of study (a fall-back option), and students who had either not engaged in career thinking (absence) or had not developed or committed to a firm identity (diffusion).

Along with choice of study major data, students’ reports of how long they intended to work in IT (time in profession) are summarised in Table 2. For this analytical step, inductive analysis was conducted to group student responses with each student response only counted once. The percentage of agreement is shown in the Table 2, with the results categorised as those who intend to work in IT for all, part, or none of their career. Students who indicated that they would not work in IT, and those who were unsure, were recorded as a fourth category.

The results in Table 2 illustrate that almost 60% of IT students intend to work in IT for the whole of their career or until a senior role emerges, with some students using terms such as “until retirement”. For example, one student wrote: “I think I will work in this area forever” and another student reported: “Hopefully it will be the start of a journey which will span to the end of my working life. I can’t see AI slowing down before I retire”. Within this ‘whole of career’ cohort, however, students added that they were unsure: for example, “I’m not sure for how long”. Overall, the results indicate that most IT students expect to work in IT following graduation, taking forward their choice of study major into career choice.

### 3.2 Career aspirations

When reporting career aspirations, students reported their expectations of career transition immediately after graduation (short-term) and five years after graduation (long-term), with outcomes shown in Fig. 3. A strong aspiration in both the short- and long-term was to work as an IT security specialist. This result is not surprising given the Australian Government’s focus on jobs in cyber security in recent years.

![Fig. 3 Career Aspirations of IT Students: Short- and Long-term](image-url)
along with new university courses in this area. Aspirations to work as a software developer or programmer also featured strongly in students’ short-term aspirations. In their long-term thinking, students aspired to take on leadership and management roles in IT.

4 Discussion: the importance of intrinsic motivation in IT

This study investigated the choice of major and career aspirations of undergraduate IT students at an Australian university. The adaptive ‘choice of major’ model shown in Fig. 1 illustrates multiple influences and enabled deductive analysis to categorise the influences relevant to IT. It was hoped that understanding students’ choice of study major and career aspirations (research questions one and two) would inform strategies to engage them in broad career development learning (Mahadeo et al., 2020; Tsakissiris & Grant-Smith, 2021).

Research question one asked, how do undergraduate IT students choose their study major (antecedents)? The data (Table 1) suggests that choice of study major for IT students is overwhelmingly driven by intrinsic motivation, expressed as an interest in, or enjoyment of the field (Bennett et al., 2016). Intrinsic motivation was expressed as person inputs in that students’ self-interest supported continued engagement in the IT discipline. The emphasis on person inputs is consistent with other studies in this area (Tsakissiris & Grant-Smith, 2021).

When reporting intrinsic interest, IT students also reported personal and social motivations for choosing to study IT. Table 1; Fig. 2 summarise the intersectionality of motivational factors together with the relative strength of each factor. Figure 2 shows that personal and social utility intersected with intrinsic interest but to a smaller degree than has been observed in other STEM disciplines (Bennett et al., 2020, 2021). Specifically, personal utility was influenced by perceived job availability rather than anticipated salary or job security. In contrast with other studies (i.e., Tsakissiris & Grant-Smith 2021), socialisation influences such as family and friends did not play a large role in motivating choice of study. However, this result is consistent with the Australian Career Interest Test and the RIASEC Holland codes (Athanasou, 2011; Liao et al., 2008), which do not associate career interest drivers for IT students with “people contact” or “social/helpers”.

Bennett et al., (2020)d Shea (2019) find that students from low-SES backgrounds tend to have less person inputs and less career and study pathways information on which to make an informed decision. From a social cognitive perspective, and knowing anecdotally the demographic profile of participating students, it is possible that some students lacked the capitals on which to make informed assessments of self- and study confidence. Both self-efficacy and outcome expectations play an important role in transforming students’ intrinsic motivation into career choice (Janz & Nichols, 2010); therefore, future studies might amass demographic data and analyse from a student equity perspective.

Along with reporting their choice of study major, students reported their intentions to work in IT. Shown in Table 2, many students reported their intention to work in IT for ‘a long time’ or ‘until retirement’, with others ‘unsure’ of how long they would
work in IT. Two-thirds of participating students were aged between 18 and 24 and 87% of them had no work experience, indicating that they were at the start of their career journeys and had under-developed career thinking. We acknowledge that the results would be markedly different among older or more experienced students. We can, however, conclude that younger incoming IT students are motivated by intrinsic interest and that they report high career commitment. Further, we can conclude that they may not yet have explored their choice of study major to make an informed career choice (Bright et al., 2005; Carduner et al., 2011; Lent et al., 2002).

Research question two asked, what are the immediate and long-term career aspirations of undergraduate IT students? Students reported that work as a cyber/ICT security specialist was a common goal for students for up to five years after graduation (Fig. 3). Software development was also a short-term goal, and many students expressed a desire to progress from technical roles to management or leadership roles in the longer term. Few students were able to articulate their career aspirations in either the short- or long term, merely responding that their work might be in IT. It is unsurprising that incoming students have yet to explore their career options. The commonality of “don’t know” and “unsure” responses, together with the inability to describe what types of IT work might be of interest, reinforces the need to engage students in intentional activities that contribute towards this career-focussed exploration (Tsakissiris & Grant-Smith, 2021). This was also seen in McKenzie et al., (2017), who found that even when university IT students presented realistic career aspirations and skills expectations, they did not have appropriate plans with which to realise their career goals, including in relation to the necessary skill development during their time at university.

Research question three asked how study choices and career aspirations inform the career interests of IT students. The link between choosing a major and career interest among university IT students, and STEM students more broadly, has been previously confirmed by Tsakissiris & Grant-Smith (2021) and by Bennett et al., (2016). The adaptive ‘choice of major’ model extended this work by exploring IT students’ emotional and pragmatic choice of study and the antecedents to career aspirations, investigating interest in line with social cognitive approaches (Lent et al., 1994).

5 Conclusions

Job prospects for aspiring IT professionals look promising over the next ten years, with opportunities growing globally (Deloitte, 2020). Despite positive job prospects, there remains a need to prepare graduates to both meet the demands of the labour market and achieve their career goals. Beyond the demands and opportunities of graduate life, rapidly changing employment opportunities and the need to maintain contemporary digital skills mean that IT graduates must maintain their employability by self-regulating their career development learning. This creates a compelling argument for universities to play a critical role in preparing students to meet Australia’s IT workforce needs (Deloitte, 2018, 2020).

CDL delivered as an embedded component of discipline studies prepares graduates for the world of work and surfaces the career relevance of study tasks. When this
is underpinned by an understanding of students’ motivations for study and career, CDL can be targeted to the cohort. The adaptive model has the potential to frame this understanding. The model (Fig. 1) presents career interest as socially constructed, with prior learning experiences, person inputs, and background contextual variables of primary influence. These factors mediate efficacy beliefs, outcome expectations (effort expended) and interest. In this study, IT students’ career interest was explored through their reported choice of study major, time in profession, career aspirations and background. The results suggest that intrinsic motivation (interest) is the primary motivator for IT students when choosing what to study at university. However, many IT students begin their studies with immaturity regarding professional expectations and career plans, and therefore may find it difficult to translate interest to career choice (Watts, 2006).

Understanding students’ motivation for study could also be leveraged to engage students in CDL early in their studies. The findings indicate that prospective IT students, and school leavers in particular, would benefit from career counselling that helps them to explore and validate their interest before making a study choice. Overall, the findings add weight to the notion that student transition is not limited to the transition ‘in’ to university; rather, students need support to transition through university and out into the workforce (Bennett et al., 2020; Deloitte, 2020).

As Lent et al., (1994) argue, development of career choice is largely a cognitively mediated activity for an individual to arrive at efficacy appraisals. As such, practical approaches should consider the developmental needs of the cohort under consideration. Although this is difficult for educators and career professionals to deliver cohort-specific interventions, self-appraisal using the ‘career choice’ model has the potential to inform these interventions and to engage students early in career exploration early in their studies.

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Declarations

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