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Coincidental development of talent in university students

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Abstract: This research investigated how tertiary students perceived their talents and the coincidental learning that occurred over a semester. The tertiary students (n = 467) were 379 females with a mean age of 22.63 years (SD = 6.84) and 88 male students with a mean age of 23.97 years (SD = 6.24). The aim of the research was to establish whether there was a change over the duration of a semester and whether gender was also associated with respondents' talent ratings. Following multiple intelligence (MI) theory, talents as manifestations of MIs were measured. Each talent was rated on seven concepts of learning. Results showed nine factors emerged in conjunction with the seven conceptions of learning, as they have in previous research. Importantly, there were small but significant differences between the beginning and the end of semester scores of seven of nine talents, indicating coincidental learning. Highest ranking of the talents were self-awareness, language and communication, and social and leadership talents. The ranking of the concepts of learning based on the average contribution to each talent was consistent with previous research, and showed performance and then natural ability to be highest ranking. These findings support the suggestion that tertiary students' talents improve coincidentally with formal study and is deserving of further research.

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ABOUT THE AUTHOR

Terence Bowles is a senior lecturer in Educational Psychology in the School of Education at the University of Melbourne. He was a teacher before beginning a career as a practitioner in Educational, Developmental and Clinical Psychologist. He has practised in secondary schools followed by a career as a private practitioner. At the completion of his PhD, he began a career as an academic. He is the author of 50 peer reviewed papers. His university teaching and research programmes focus on clinical and normal functioning, motivation, achievement, communication and relationships. He has published on change management, adaptive functioning, social and emotional learning time orientation and affect, consultation, giftedness, talent and talent development.

PUBLIC INTEREST STATEMENT

Billions are spent by governments, and private organisations and institutions annually to develop the talents of people, particularly through formal education. This article describes how tertiary students go about developing their talent over the course of a semester course. Nine general talents were measured and the ways those talents were acquired are described to identify what was learned indirectly while participating in formal university course. Over the course of a semester, small but significant increases in the perception of talent of the students occurred, the highest talents ranked were in the areas of self-awareness, language and communication, and social and leadership brought about mostly by performance and natural ability. This is important as these coincidental learnings are relevant to personal and professional domains of life. The findings provide evidence that the benefits of formal education go beyond specific skill development and knowledge acquisition specific to the course being study.

Subjects: Teaching Practice - Education; Education & Training; Educational Technology; Post 16 Education; Adult Education and Lifelong Learning; Educational Research; Higher Education; Theories of Learning; Classroom Practice; Educational Psychology

Keywords: talent development; concepts of learning; coincidental learning; strength-based learning; graduate attributes

1. Introduction

Tertiary students are expected to be talented and have their talents developed at university, despite there being little research into how this occurs (Garrett & Davies, 2014). According to Renzulli (2012), the development of students' talent is effective when: (1) above average students are taught; (2) students also have a creative disposition characterised by originality, ingenuity and a willingness to challenge conventional ways; and (3) students are also highly committed, characterised by perseverance, determination and willpower. Students are taught through a model of enrichment, where leadership in the student is promoted in order to enable their talent expression and development to function in a socially aware and responsible manner. The development of talent at university has typically been associated with the identification of people who show outstanding ability from elite or sub-elite levels at entry to a course of study typically associated with various advanced skills, including ego orientation, physical capabilities and resilience/effort (tolerance of fatigue; Reilly, Williams, Nevill, & Franks, 2000). Second, talent development is associated with advanced mental and cognitive ability through specific interventions and strategies, such as Gagné's (2011) six elements of talent development: selective access, enriched curriculum and training, clear and challenging goals, systematic and regular practice, regular objective performance, and personalised pacing of the programme, with modifications for individual differences and context (Grassinger, 2011). Talent has also been associated with complex, adaptive processes towards skill acquisition (Araújo & Davids, 2011; Araújo & Keith, 2011) and with developing abstract and authentic experiences to enhance talent by engaging with technology and partnering with organisations beyond the university (Florida, 1999).

Resources, agency and product or outcome are central to these interventionist models based on (gifted) acquisition and enrichment of internal states and skill development (Dries, 2013). Other researchers (e.g. Davids & Araújo, 2010; Dunwoody, 2006) have argued that these acquisition and enrichment approaches have resulted in organismic asymmetry in understanding human behaviour, understating the importance of environment and context and its influence in developing proficiency and talent (Turvey & Shaw, 1995). In this research, talents were investigated with a cohort of university students to redress this asymmetry. The focus was not on the top 10% of students as suggested by some researchers (e.g. Gagné, 2004) nor on domain-specific excellence (Simonton, 1999) but on talent as a result of incidental learning (Sharples et al., 2015), manifested as improvements over a semester. The nine talents are the operationalisations (Bowles, 2004) of Gardner's (1999) multiple intelligences (MIs).

1.1. Graduate attributes and talent development

The capacity to translate specific knowledge, skills and competence from a tertiary course to another context, usually work, is assumed to be a necessary aspect of tertiary learning (Scott, 2014). Universities typically consider these graduate attributes as generic and exemplified by general attributes associated with ethical responsibility, scholarship, critical thinking, communication, collaboration, creativity and confidence (Ipperciel & Elatia, 2014). There is variability in attributes that are specific to courses of study, exemplified by Cranney et al.'s (2009) list pertinent to the study of psychology: knowledge and understanding, research methods, critical thinking, values, communication and applications of psychology. The generic skills and competencies are embedded within the curriculum of the specific course, and a progression in the development of the competencies and complexity is associated with advancement to the later years of the degree (Bennett, Dunne, & Carre, 1999). The consideration of competencies in the context of talent development is important. A student's talents, like graduate attributes, are not ordinarily explicitly taught in courses (Bennett et al.,

1999) but rather occur as a result of incidental learning. Following graduate attributes, it is expected that graduating students are more talented than when they started and consequently should be more talented over the duration of a semester of a course in a tertiary institution.

1.2. The process of talent development in incidental and coincidental learning

Talents develop in tertiary settings via a complex interaction between the individual and the environment (Araújo & Davids, 2011) over time and through contact with a rich learning environment with people and activities that prompt change in cognitive functioning and thought, refined skill development, practice activities, and enhanced attitudes and values about competence aligned with motivational and emotional states (Araújo & Davids, 2011). This change corresponds to Gagné's (2010) view that the environment, which is comprised of the milieu (physical, cultural, social and family), the individuals (parents, family, peers, teachers, mentors) and provisions (enrichment, curriculum, pedagogy, pacing, grouping and acceleration) are fundamental elements of talent development. That is, what is learnt specifically about a subject in a programme may spill over and allow the student to consciously or unconsciously relearn and reapply knowledge and skills, knowledge, attitudes and values into other contexts. This process is called incidental learning and can be defined as "a by-product of some other activity such as sensing the organisational culture, or trial and error experimentation" (Marsick & Watkins, 1990, p. 8). Corresponding to the talent literature, talent is the manifestation of capabilities learnt and fostered at university or at work (Marsick & Watkins, 1997; Scott, 2014; Sharples et al., 2015) that are incidental to the study of specific subjects and curricular, whereas giftedness is the strength and capability of the individuals to pursue their best outcomes (Dries, 2013; Wood, Linley, Maltby, Kashdan, & Hurling, 2011) usually in some specialty. In this research, the measurement of the change is coincident to studying over a semester of time and coincidental learning is defined as a by-product of some other activity that results in unplanned and unintended consequences that change the individual's perception, self-perception, capabilities or sense of mastery, at the same time as they engage in intentionally learning another subject of a course of study. This research investigates whether students increased their coincidental learning—in particular, their perception of their talent and concepts of learning—over a semester of university study.

1.3. MIs and talent and concepts of learning

There has been little research into the consistency of tertiary students' perceptions of their talent and its development. Talents are manifestations of what Gardner defines as multiple intelligences, "a bio-psychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (Gardner, 1999, pp. 33–34) and the products of raw potentials requiring development. MIs become talents when they are displayed with varying degrees of skill or competence (Bowles, 2004; Klein, 2008; Scaturo, 2010). Originally, there were seven intelligences: Spatial, Linguistic, Logical-Mathematical, Physical and Sport Activity, Musical, Social and Leadership, and Self-Awareness (Gardner, 1999). Naturalistic and Existential MIs were added more recently (Gardner, 1999, 2000; Tirri, Nokelainen, & Komulainen, 2013).

One of the unique aspects of this research is the measurement of talents based on concepts of learning. The concepts of learning on which the talents are rated were derived from asking adolescents and adults how achieving individuals develop and maintain their talents (Bowles, 2004). The concepts rendered were similar to the mastery-approach goal conceptualisations of Hulleman, Schrager, Bodmann, and Harackiewicz (2010): Understanding, Performance, Natural Ability, Ease, Interest, Preoccupation and Effort (Bowles). Matching these terms with the list of significant factors shown to influence university students' academic performance from a recent meta-analysis (Richardson, Abraham, & Bond, 2012) showed a strong match. Of the 50 factors listed as significant correlates, 26% were related to performance, 16% with understanding, 12% with effort, 8% with natural ability, 4% with interest and 4% with preoccupation. Therefore, the seven concepts of learning were associated with 76% of the variance of factors identified as influencing academic performance with other factors not associated with the individual learner.

Previous research involving the measurement of talent through ratings of concepts of learning, with adolescent respondents was statistically well structured and valid and the contribution to the talents by each concept of learning is relatively consistent. The rank of the concepts of learning is derived from an average of the rank of each communality score (of the exploratory factor analysis) of each concepts of learning across the nine talents. This rank is an index of which concepts of learning contribute most to the talents. The average rank of the previous concepts of learning contributing to the nine talents, with the adult (nontherapeutic) sample (Bowles, 2013) shown first in parentheses and the adolescent (Bowles, 2008) sample shown second, were (first to last ranked): Performance (1.44; 1.33), Natural Ability (2.33; 3.44), Understanding (3.67; 3.78), Ease (3.78; 3.44), Interest (4.00; 4.33), Effort (6.89; 5.22), Pre-occupation (5.22; 6.00). The rank was relatively similar for both adult and adolescent responses with Ease ranked differently and Preoccupation and Effort reversed in order. A Spearman's rank order correlation of adolescent and adult rankings showed these concepts of learning were correlated to .865 (p = .012). The seven concepts of learning represent the ways individuals develop and maintain their talents (Bowles, 2004). In this research, the nine talents were rated on each concept of learning to generate the coefficients that are analysed to establish the factor structure of talents of tertiary students. The talents have previously had good factorial structure when completed by adolescents, with the highest to lowest talents being: Physical and Sport, Musical and Rhythmic, Construction and Spatial Design, Social and Leadership, Language and Communication, Nature and Environment, Mathematical and Logical, Self-awareness, Spiritual and Religious, and Total Talent (Bowles, 2008). However, as the current research is investigating the talent of tertiary students, who are a less representative group than those at secondary school, it is possible that there will be some discrepancy in the rank.

Previous adult research has shown that weak, significant gender effects have been found, with males scoring significantly higher than females on Construction and Spatial Design, and Mathematics and Logical (Bowles, 2013). The magnitude of the difference between males and females was small to negligible and not consistently higher for either gender. Adolescent research measuring the talents has shown that weak gender effects have also been found in an adolescent sample showing that males rated themselves higher on Mathematical and Logical, and Construction and Spatial Design factors whereas females rated themselves higher on Self-awareness, and Nature and the Environment (Bowles, 2008).

1.4. Research questions

To establish whether talents and conceptions of learning are relevant for tertiary students, the following questions were asked. (1) Is there a factor structure consistent with previous research in which concepts of learning separate and load on the appropriate talents? (2) Which concepts of learning contribute (by rank) to the factors of talent? (3) Which talents are rated as highest by the university students? (4) Are there increases in tertiary students' perceptions of their talent over the duration of a semester? (5) Do males and females vary on the talent scores?

2. Method

2.1. Participants

A total of 467 tertiary students enrolled in arts, social sciences and education courses from one metropolitan university in an Australian capital city participated in this research. The ages of the students ranged from 18 to 63 years. The median and mode of the ages was 20 years (n = 193). The mean age of the 379 females was 22.63 years (SD = 6.84) and the mean age of the 88 male students was 23.97 years (SD = 6.24). There was no significant difference in age by gender, $F(1, 465) = 2.84$, $p < .093$, $\eta_p^2 = .01$. For each year, the approximate number of full-time students was two thirds; however, this is difficult to establish as even full-time students sometimes had large work responsibilities and/or changed status during semester.

2.2. Procedure

Questionnaires were completed in week one and week 13 of the semester. Through the verbal instructions and the instructions on the questionnaire (Appendix 1), the respondents were asked, "In which set of activities (talent indicators) are you interested?" ("interest" is one of the seven conceptions of learning). Participants then rated their interest in each of the nine talents on a Likert-type scale, shown on the top of each page of the questionnaire. Ratings were recorded on an answer sheet. Students kept the answer sheets from week one in a folio of their course work. During the last seminar in week 13, students were invited to complete the questionnaire again. Students were then invited by one of the tutors in the course to submit both answer sheets with a signed consent form if they desired. Discussion on ways of improving concepts of learning and talent occurred after submission of the answer sheets. Data were only collected if both time 1 and 2 answer sheets were being submitted. The overall response rate of matched (times 1 and 2) answer sheets was 59% of the students enrolled. The time between time 1 and time 2 was 13 weeks.

2.3. Questionnaire

The Talent Questionnaire is a booklet of terms defining each talent and accompanied by a Likert-type scale of each concept of learning heading on each of seven pages. These begin with a Likert-type scale to be applied to the nine talents described in the page (see below). Each Likert-type scale defines the Interest, Ease, Effort, Understanding, Performance, Pre-occupation and Natural Ability associated with each talent. The Likert-type scale ranges from 1 = *not* ... (The individual approach to learning was inserted here, e.g. Interested) to 5 = *extremely* ..... The verbal instructions were:

> Respond to each statement using the SCALE from one to five on each page. Put the number indicating your response in the appropriate square on the answer sheet.

Corresponding written instructions appear on the questionnaire and sample items are provided in the Appendix 1. In all, the questionnaire contains 63 items. A detailed description of the questionnaire and its validity has been previously published (Bowles, 2008, 2012).

3. Results

An exploratory factor analysis was completed to establish the initial factor structure. The exploratory factor analysis was conducted on the time one portion of the data-set. The rank order of the conceptions of learning was deprived by averaging the rank order of each conception of learning, based on the order of the communality of each conception of learning across the nine talents. The confirmatory factor analysis was conducted on the time two portion of the data-set. The confirmatory analysis was completed on 460 complete sets of data and the remaining analyses were completed on the 467 sets of data. All the subsequent analyses were calculated based on the items to factor structure of the confirmatory factor analysis. As no mean substitution was applied to missing data, cases with missing data were deleted listwise, therefore the analyses after the confirmatory analysis varied slightly and for the MANOVAs was 454 respondents.

To establish the structure of the talent questionnaire for a graduate student cohort, a factor analysis with varimax rotation and maximum likelihood was completed on the 63 items, as the factors had shared low correlations in previous research (Bowles, 2008; Fabrigar, Wegener, MacCallum, & Strahan, 1999; Hair, Black, Babin, & Anderson, 2010; Tabachnick & Fidell, 2013). Nine factors, as shown by the pattern matrix of the structure shown in Table 1, emerged from the analysis. The unrotated factor solution accounted for 59.11% of the cumulative variance and moderate to high loadings for each contributing items to factors, which was above the significant level for the sample size (Hair et al., 2010). Communality values for items ranged from low/moderate to excellent. Inspection of the scree plot indicated that the best solution was an "elbow" after the nineth factor, which reflected the structure of the designed questionnaire. Each factor contributed substantially to the communality, with a range of 6.01 to 7.40. The Kaiser–Meyer–Olkin measure of sampling adequacy was very good at .86, and the Bartlett test of sphericity measured the overall significance of the

Table 1. Pattern matrix of the structure of nine talents at time 1

Talents concepts of learning	1	2	3	4	5	6	7	8	9	h^2
Physical and sport activity										
Performance	.89									.83
Natural ability	.87									.78
Interest	.84									.74
Understanding	.83									.72
Ease	.82						.17			.72
Preoccupation	.69									.49
Effort	.63									.41
Spiritual and religious										
Performance		.86								.79
Interest		.83								.72
Natural ability		.82							.17	.73
Ease		.79							.16	.68
Understanding		.76						.16	.17	.63
Preoccupation		.69								.50
Effort		.68								.48
Musical and rhythmic										
Performance			.90							.84
Natural ability			.86							.77
Understanding			.85							.73
Ease			.78							.63
Interest			.74							.60
Preoccupation			.62							.41
Effort			.55							.32
Construction and spatial design										
Performance				.87						.79
Ease				.86						.78
Natural ability				.86						.76
Understanding				.79			.17			.67
Interest				.75						.60
Preoccupation				.55						.31
Effort				.50						.29
Nature and environment										
Performance					.83					.73
Natural ability					.81					.72
Understanding					.78					.64
Interest					.76					.64
Ease					.72				.18	.58
Preoccupation					.65					.46
Effort					.57					.37
Mathematical and logical										
Performance						.88				.80
Natural ability				.15		.86				.77
Ease				.15		.83				.73

(*Continued*)

Table 1. (*Continued*)

Talents concepts of learning	1	2	3	4	5	6	7	8	9	h^2
Understanding						.82				.70
Interest						.74				.56
Preoccupation						.56				.33
Effort						.38				.16
Social and leadership										
Performance							.79			.67
Natural ability							.77		.15	.65
Ease							.76			.61
Understanding							.73		.15	.58
Interest							.69			.50
Effort							.66			.44
Preoccupation							.61		.16	.41
Language and communication										
Performance								.85		.76
Natural ability								.81		.70
Ease							.15	.79		.67
Interest								.73		.58
Understanding								.73	.16	.57
Preoccupation								.51		.29
Effort								.44		.23
Self-awareness										
Natural ability									.84	.76
Performance								.15	.78	.68
Understanding								.17	.75	.62
Ease									.71	.55
Interest									.60	.39
Preoccupation									.59	.40
Effort									.50	.28
Rotation sums of squared loading (cumulative %)	7.40	14.51	21.27	27.93	34.49	40.92	47.03	53.10	59.11	
Cumulative eigenvalue (cumulative %)	13.51	23.75	32.36	39.54	45.85	51.38	56.27	60.59	64.53	
Cronbach's α (time 1)	.93	.92	.91	.90	.90	.89	.89	.88	.88	

Notes: Eigenvalues have been rounded to hundredths; values of .25 and above are included in the table. Only loadings above .15 are included in the table.

correlation and showed adequacy, $X^2(9, N = 454) = 20{,}586.93$, $p = .001$, both of which were satisfactory (Hair et al., 2010; Tabachnick & Fidell, 2013).

The average rank of concepts of learning from the communalities of time 1 factor analysis showed that the first ranked factor was Performance (1.11), followed by Natural ability (2.11), Ease (3.78), Understanding (3.89), Interest (4.33), Preoccupation (6.11) and with Effort (6.89) as the lowest ranked factor. The average rank order of the tertiary group's concepts of learning showed a similar rank to the adolescent group (Bowles, 2008): Performance, Natural Ability, Ease, Understanding, Interest, Effort and Preoccupation. Only the third and fourth ranked (Understanding and Ease) and

the sixth and seventh ranked (Effort and Preoccupation) concepts were reversed. A Spearman's rank correlation of the mean ranks from the adolescent and the tertiary group showed there was little variability with the correlation of .955 (p = .001). In relation to the adult group, the tertiary concepts of learning were the same rank order except for Ease and Understanding, which were reversed. The correlation of the mean ranks from the adult and the tertiary group showed little variability, with a correlation of .979 (p = .001).

After examination of the loadings of the exploratory analysis and confirmatory loadings, and modification indices of the covariances, the best fitting structure was achieved with the four items for each factor, and therefore a total of 36 items defined the nine factors (no errors were covaried in the analyses). The fit indices of the time 2 data showed $\chi^2(558, N = 453) = 1118.04$, p = .001, c^2/df = 2.01, GFI = .873, AGFI = .849, CFI = .945, TLI = .938, RMSEA = .047 and RMR = .044, indicating a relatively good model fit. The contributing coefficients and factor structure are shown in Table 2. In all comparisons of means, the factors were based on the time factors structure from the AMOS analysis.

Table 2. Regression weights relevant from the CFA of the talent questionnaire at time 2

Talents concepts of learning	Parameter estimate	Standard error	Estim/*SE* Critical ratio of regression weight	Standardised coefficients
Language and communication				
Interest	1.00			.80
Ease	1.09	.06	17.36	.82
Effort	.91	.07	13.11	.62
Natural ability	1.10	.07	16.45	.79
Mathematical and logical				
Interest	1.00			.76
Ease	1.18	.06	20.22	.88
Performance	1.14	.06	19.38	.88
Natural ability	1.24	.07	19.11	.87
Construction and spatial design				
Ease	1.00			.86
Understanding	.90	.04	22.33	.84
Performance	1.00	.04	24.95	.89
Natural ability	1.07	.05	23.73	.86
Physical and sport activity				
Interest	1.00			.83
Ease	1.01	.05	20.68	.85
Preoccupation	.89	.06	15.29	.66
Natural ability	1.11	.05	21.27	.88
Musical and rhythmic				
Interest	1.00			.75
Understanding	1.13	.06	18.00	.85
Performance	1.31	.07	19.10	.89
Natural ability	1.26	.07	18.36	.85
Social and leadership				
Ease	1.00			.76
Understanding	.86	.06	14.71	.71

(*Continued*)

Table 2. (*Continued*)

Talents concepts of learning	Parameter estimate	Standard error	Estim/*SE* Critical ratio of regression weight	Standardised coefficients
Performance	1.05	.06	16.63	.83
Natural ability	1.09	.07	16.19	.79
Self-awareness				
Interest	1.00			.75
Understanding	1.05	.06	16.91	.80
Performance	1.18	.06	18.70	.88
Natural ability	1.19	.06	18.23	.85
Nature and environment				
Interest	1.00			.77
Ease	.92	.04	21.76	.83
Performance	1.01	.04	24.42	.88
Natural ability	.79	.05	16.34	.82
Spiritual and religious				
Ease	1.00			.88
Understanding	1.05	.06	18.52	.82
Performance	1.06	.05	19.48	.89
Preoccupation	.98	.05	18.10	.68

The frequency of concepts of learning after the confirmatory factor analysis (time 2), contributing to the factors were Natural Ability ($n = 8$), Ease ($n = 7$), Performance ($n = 7$), Interest ($n = 6$), Understanding ($n = 5$), Pre-occupation ($n = 2$) and Effort ($n = 1$).

The correlations (Table 3) showed that the factors were weakly to moderately related with 70 of 100 correlations (both times 1 and 2) being significant. All factors were significantly correlated, with the total talent score reflecting the factor structure. The time 1 and time 2 factor correlations were all above .71. The alpha reliability of each of the factors was high with no reliability less than .81 at time 1 or 2 (Boyle, 1991).

A repeated measures MANOVA was used to measure the differences between the talents, time of testings and gender of the respondents. The normality, linearity and multicollinearity of the relevant variables were satisfactory. Wilks' criterion indicated that the combined dependent variables were significantly related to difference of time, $F(10, 443) = 5.50$, $p < .001$, $\eta_p^2 = .11$. There was a mulitivariate main effect for gender with $F(10, 443) = 4.73$, $p = .001$, $\eta_p^2 = .10$, and the time by gender interaction was not significant, $F(10, 443) = 1.66$, $p = .09$, $\eta_p^2 = .04$. The univariate analysis showed no interaction involving time of testing and gender, therefore the IVs were analysed separately. Table 4 shows the univariate analysis of talents over time, indicating that there was a significant effect for each talent except Self-awareness, Nature and Environment, and Spiritual and Religious. The gender effects were calculated on the average of the time 1 and 2 scores (Figures 1 and 2), with males scoring higher on Mathematical and Logical, Construction and Spatial Design, and Physical and Sport Activity (Table 5).

Table 3. Correlation of time 1 and time 2 of talents over a 13-week semester

	1	2	3	4	5	6	7	8	9	10	α
(1) Language and communication	.71**	.08	.01	−.06	.19**	.21**	.27**	.06*	.23**	.46**	.81
(2) Mathematical and logical	.15**	.78**	.26**	.02	−.09	−.01	−.10*	−.01	.01	.30**	.91
(3) Construction and spatial design	−.04	.37**	.79**	.13*	.07	.05	−.08	.18**	.06	.44**	.92
(4) Physical and sport activity	−.01	.08	.15**	.88**	.14**	.19**	−.09*	.08	−.06	.37**	.89
(5) Musical and Rhythmic	.15**	−.03	.03	.13**	.79**	.11*	.12**	.17**	.08	.46**	.91
(6) Social and leadership	.19**	.03	.02	.17**	.17**	.71**	.21**	.12**	.14**	.47**	.87
(7) Self-awareness	.35**	.03	−.06	−.05	.16**	.25**	.75**	.27**	.30**	.43**	.83
(8) Nature and environmental	.13**	.02	.22**	.11	.24**	.15*	.29**	.82**	.26**	.54**	.88
(9) Spiritual and religious	.18**	.02	.03	−.10*	.09	.15**	.33**	.29**	.80**	.51**	.87
(10) Total talent (mean)	.45**	.43**	.45**	.36**	.47**	.46**	.51**	.60**	.49**	.77**	.82
Cronbach's α	.84	.91	.92	.88	.90	.85	.86	.90	.89	.85	

Notes: Above the diagonal are time 1 and below are time 2 correlation coefficients. The diagonal is the correlation of the same factors at times 1 and 2. Correlations for factors were calculated on the confirmatory factor structure for times 1 and 2.

*$p < .05$.

**$p < .01$.

Table 4. Repeated measure analysis of the effect for talent

Main effects talent group	Elements of the variation					Effect		
	Time 1		Time 2			Significance		
	Mean	SD	Mean	SD	D^2	*F*	*p*	η_p^2
Self-awareness	3.88	.79	3.91	.88	.02	1.58	.210	.003
Language and communication	3.58	.84	3.76	.82	.22	38.07	.001	.077
Social and leadership	3.57	.84	3.66	.81	.11	7.72	.006	.017
Musical and rhythmic	3.42	1.01	3.52	1.01	.10	10.26	.001	.022
Physical and sport activity	3.21	1.06	3.31	1.05	.09	16.07	.001	.034
Nature and environment	2.90	.97	2.93	1.00	.03	1.24	.267	.003
Mathematical and logical	2.72	.97	2.85	1.05	.13	17.01	.001	.036
Construction and spatial design	2.57	.99	2.66	1.03	.09	9.98	.001	.022
Spiritual and religious	2.58	1.06	2.58	1.13	.00	.01	.942	.001
Total talent (mean)	3.15	.42	3.24	.46	.09	34.34	.001	.070

Notes: Repeated measures MANOVA comparisons are indicated by the exact significance level (df = 1, 453).

d = Cohen's *d*.

The rank of the tertiary students' ratings of talents is shown in Table 6. The mean of each talent was compared using pairwise *t* tests to establish which factors were significantly different from each

Figure 1. Talents differentiated by time.

Notes: *$p < .05$; **$p < .01$.

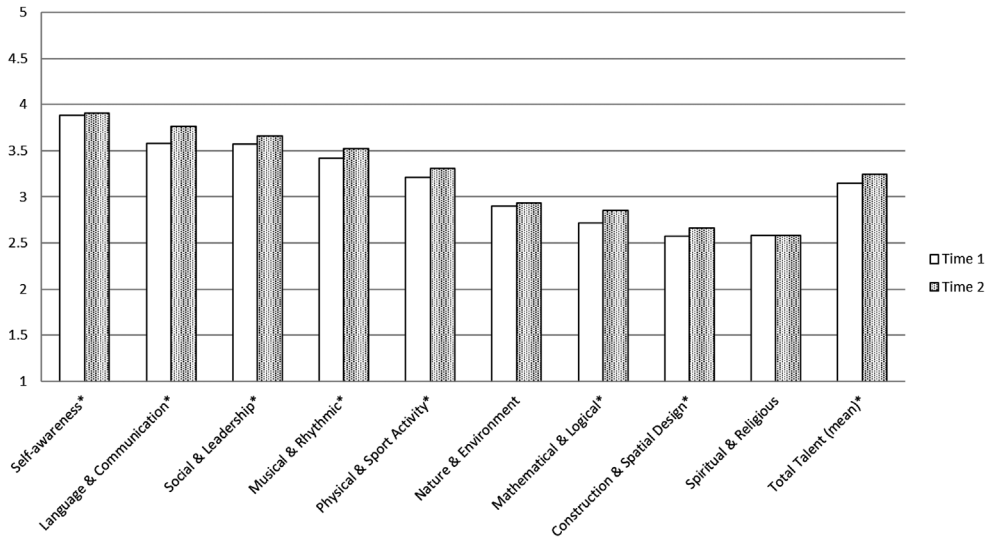
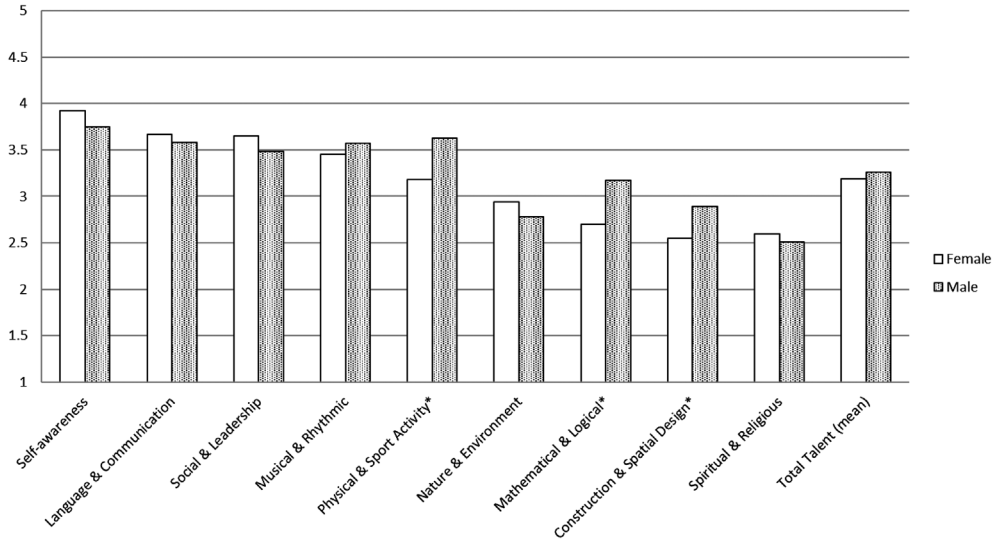


Figure 2. Rank of total talent of males and females represented by gender.

Notes: *$p < .05$; **$p < .01$.



other factor. The non-adjacent means were significantly different in all cases except Language and Communication with Social and Leadership, and Physical and Sport Activity with the Total Score. The rank revealed that Self-awareness, Language and Communication, and Social and Leadership were highest ranking; middling were Musical and Rhythmic, Physical and Sport Activity, and Nature & Environment; and the lowest ranking factors were Mathematical and Logical, Construction and Spatial Design, and Spiritual and Religious.

Table 5. Gender effects for talent

Main effects talent group	Elements of the variation					Effect		
	Females		Males			Significance		
	Mean	SD	Mean	SD	*d*	*F*	*p*	η_p^2
Self-awareness	3.92	.85	3.75	.97	−.17	3.38	.066	.007
Language and communication	3.68	.84	3.58	.76	−.11	1.23	.268	.003
Social and leadership	3.65	.84	3.65	.74	−.21	3.23	.073	.007
Musical and rhythmic	3.45	.99	3.57	1.08	.12	1.07	.302	.002
Physical and sport activity	3.18	1.04	3.63	1.03	−.43	13.66	.001	.029
Nature and environment	2.94	.96	2.78	1.07	−.16	2.09	.148	.005
Mathematical and logical	2.70	.99	3.17	.87	.50	17.26	.001	.037
Construction and spatial design	2.55	.98	2.89	1.05	.33	8.59	.004	.019
Spiritual and religious	2.60	1.06	2.51	1.12	−.09	.44	.507	.001
Total talent (mean)	3.19	.45	3.26	.47	.08	2.35	.125	.005

Notes: Cohen's *d* for calculating differences between groups of different size; Simple main effects ANOVA comparisons of means averaged over two data gatherings are indicated by the exact significance level (df = 1, 452). Slight discrepancies in rank occur as a result of the averaging of the gender scores over two time points. There is no significant difference between factors that rank differently between the time and gender tables.

Table 6. Rank, mean, standard deviation and *t* scores of pairwise mean comparisons of talents at time 1

	Mean	SD	*t* score value								
			2	3	4	5	6	7	8	9	10
1. Self-awareness	3.88	.79	6.66**	6.53**	8.13**	10.60**	19.87**	18.84**	21.14**	24.73**	21.53**
2. Language and communication[1]	3.58	.83		.121	2.82*	5.93**	11.98**	14.88**	16.61**	17.78**	12.60**
3. Social and leadership	3.57	1.00			2.57*	6.62**	12.22**	14.12**	16.88**	16.70**	12.09**
4. Musical and rhythmic	3.43	1.02				3.60**	8.98**	10.17**	13.28**	12.66**	6.28**
5. Physical and sport activity	3.20	1.07					4.75**	6.99**	9.72**	8.30**	.750
6. Nature and environment	2.89	.98						2.47*	5.34**	5.13**	−7.08**
7. Mathematical and logical	2.73	.97							2.76*	2.02*	−9.86**
8.Construction and spatial design	2.58	1.00								−.27	−13.99**
9. Spiritual and religious	2.59	1.07									−13.17**
10. Total talent (mean)	3.16	.42									

*$p < .05$

**$p < .01$.

Note: All comparisons d$f = 467$.

4. Discussion

The factor structure of the exploratory factor analysis was consistent with previous research, with the relevant concepts of learning loading appropriately for each of the talents. This result is consistent with the previous research. The confirmatory factor analysis indicated that the concepts of learning loaded variously on the talents. The result was that four of the concepts of learning loaded on each talent. Interestingly, the most frequently contributing concepts of learning were Natural Ability, Ease, Performance and Interest. Alpha reliability was reduced after fewer items were found to contribute to each factor.

The ways in which adolescents develop each of the nine talents was shown by the order of the concepts of learning. The relative consistency of the concepts of learning in relation to the tertiary students with the previous research on adults (Bowles, 2013) and adolescents (Bowles, 2008) is high. Consistently, first and second ranked were Performance and Natural Ability, respectively. Consistently, third, and fourth or fifth ranking were Ease, and Understanding or Interest, respectively. The sixth and seventh ranking were Preoccupation and Effort, respectively. Interestingly, Preoccupation and Effort are often observed in the behaviours of elite and high performing individuals. That performance and natural ability are ranked so high is somewhat problematic for tertiary institutions, as online and large-scale seminar programmes do not provide optimal opportunities to demonstrate performance with peers. Similarly, academic courses do not always reflect a student's natural ability. Improving the goodness of fit between performance and the natural ability of students and course offerings would result in a potentially more positive and possibly more educative and rewarding experience for students (Garrett & Davies, 2014).

Following the confirmatory factor analysis, the frequency of the concepts of learning that contributed to the structure of the talents showed considerable variability and differed from the order from the exploratory analysis, with all seven concepts contributing, and concepts associated with the majority of talents being: Natural Ability, Ease, Performance, Interest, Understanding, Pre-occupation and Effort (with Preoccupation and Effort contributing least—less than twice). Assisting students to understand the benefits of the application of a variety of concepts of learning and how to apply them variously to specific learning tasks may also enhance the student learning experience (Gagné, 2004).

4.1. Talents rated as highest by the university students

The highest rating talents from the exploratory factor analysis of the tertiary students' ratings were Physical and Sport Activity, Spiritual and Religious, and Musical and Rhythmic, followed by Construction and Spatial Design, Nature and Environment, Mathematical and Logical, Social and Leadership, Language and Communication, and Self-Awareness. The order of the nine factors from the exploratory analysis varied widely when compared with the confirmatory analysis (r = -.183, p = *ns*) in this research, whereas a stronger order was associated with the previously reported adult research (r = .817, p = .007; Bowles, 2013) and adolescent results (r = .700, p = .037; Bowles, 2008). Despite the absence of a consistent rank order effect and variability in the tertiary sample, most probably being due to method effects, the item to factor structure is particularly consistent and strong in this research and with other samples and age groups. It is very likely that the order and relevance of talents is very context driven and influenced by factors such as work (Asheim & Hansen, 2009), education (Ng, 2011) and recreation (Anderson & Heyne, 2012).

4.2. Tertiary students' perceptions of their talent over the duration of a semester

There were consistent, weak increases in tertiary students' perceptions of their talent over the duration of a semester in seven of the nine talents and total talent scores, all indicating an increase in talent over time. The largest differences involved talents most likely influenced by academic involvement: Language and Communication, and Mathematical and Logical talents. Similarly, the two talents least likely to be influenced coincidentally by involvement in academic study were Nature and the Environment, and Spiritual and Religious.

Importantly, this research reports the possibility of coincidental learning, or secondary gains or byproducts of learning through generalisation as a function of participation in formal tertiary programmes or work (Marsick & Watkins, 1990, 1997; Scott, 2014; Sharples et al., 2015). While the occurrence and definition of incidental learning has been discussed extensively in the literature for some time (Marsick & Watkins, 1997), measuring the effect has held back the research. Measuring the coincidental gains on an individual's perception of their own talent, coincident with participation in a semester of tertiary learning, provides a mechanism to operationalise the process more precisely. The changes in talent scores over time lend some support for claims that non-subject-specific

graduate attributes can be developed and generalised by engaging in formal educational processes (Ipperciel & Elatia, 2014).

4.3. How males and females vary on the talent scores

Corresponding with previous research, weak gender effects were found in which males rated higher on Construction and Spatial Design, and Mathematics and Logical (Bowles, 2013). The previously difference in which female adolescents rated higher in Self-awareness, and Nature and the Environment (Bowles, 2008) was not found. Males were also found to have a significantly higher rating on Physical and Sport Activity. Importantly, these effects are weak and may reflect the different ages and educational contexts of these respondents.

This research is relevant to the development of the conceptualisation and measurement of talents as manifestations of multiple intelligences (Gardner, 1993a, 1993b) of university students. The findings are also pertinent as they provide evidence of the factor structure of the talents in relation to the concepts of learning that extend research into talent development. Coincidental learning is exceptionally important as a byproduct of study and as a byproduct of work (Marsick & Watkins, 1997). If the average gain in coincidental learning that was made over one semester, $\eta_p^2 = .056$; Cohen's $d = .09$), which was small, was projected over the life of a nine-subject, three-year degree, the average coincidental learning gain would be nine times greater, which would be considered a large effect size gain (Kotrlik & Williams, 2003). Identifying, promoting and developing coincidental learning at the institutional level and increasing the possibility of individual students generalising specific learning to their own coincidental learning prepares them to be more effective learners in the university and the workplace.

Although it has so far been found to be weak, further research into the effect of gender is necessary. Understanding whether the gender effects are the expression of a bias or a genuine effect requires further investigation. Understanding the long-term effect of the gender effects found over a semester, whether a bias or a real phenomena, is also worthy of further investigation. Further research into coincidental learning within educational and work contexts is necessary to establish whether these effects are aberrations or real phenomena.

In conclusion, the research presented shows the worth of developing knowledge about the identification and benefits of talent development and coincidental learning. While there is clear utility in bolstering talent and coincidental learning in the workplace, there is also much to be gained by assisting students to understand the benefits of, and their role in fostering, their talent and coincidental learning.

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Appendix 1:

Introduction and sample of items of the questionnaire

Interest inventory

This questionnaire asks about your interests, abilities and activities in nine particular areas. Each page begins with a question which can be answered in regard to all nine areas. Respond to each statement using the **SCALE** from one to five on each page. Put the number indicating your response in the appropriate square on the answer sheet.

There is a different **SCALE** on each page. Each page is a new column on the answer sheet.

IN WHICH OF THE SETS OF ACTIVITIES ARE YOU **INTERESTED**?

	Not		Extremely
SCALE	INTERESTED	INTERESTED	INTERESTED
	1	2 3 4	5

1.1. Communicating ideas, discussing, creative & other writing, reading, acting, telling jokes, playing with language or word games.

1.2. Recognising patterns and relationships, "cracking" codes, solving problems and number patterns or calculating complex problems.

1.3. Making models, drawing, imagining how to build things, reading maps, working with wood, other material or construction sets.

1.4. A Sport/s, exercise, aerobics, physical training, creative movement, dance, acting, miming or other physical activities.