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COMPUTING STUDENTS' APPROACHES TO LEARNING IN RELATION TO ENTRY PATHWAYS AND THEIR AGE

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Abstract

This study is aimed to examine the relationship between Singaporean undergraduate computing students' approaches to learning with regard to entry pathways and their age. Data were gathered with the use of the R-SPQ-2F on 186 students. Data analysis was made through the use of descriptive statistics involving mean and standard deviation, percentages and frequency distribution, cross tabulations and one-way ANOVA. In this study, 186 out of 223 students responded, representing a percentage of 83%. The participants have a mean age of 21.45 ± 1.952 years. Out of 184 students, 133 were males, with a percentage of 72.3. In terms of entry pathways, 75 students (40.8%) were from GCE A-level, 97 students (52.7%) were from polytechnic diploma while 12 students (6.5%) were from other pathways. The findings showed that among the 184 undergraduate computing students who participated, 141 students or 76.6% utilised the deep learning approach while 43 students or 23.4% used the surface learning approach. The students' mean deep approach scores of 30.83 ± 6.307 was higher, compared that of surface approach scores of 22.74 ± 5.521. From the results, it is clear that the deep approach to learning is the most dominant learning approach regardless of entry pathways and age. Furthermore, it is evident that entry pathways and age do not have a significant effect on the learning approaches adopted by the learners.

***Keywords*:** Age, Approaches to Learning, Computing, Entry Pathway, Singapore.

1. Introduction

Student's approaches to learning (SAL) are critical in not only signifying the intention of the learner but also the way in which the student processes information (Biggs et al, 2001; Baeten et al, 2010). In essence, the type of approach that students employ is crucial because it has a significant effect on the quality of learning as well as the overall academic performance of the learners (Duff et al, 2004). Consequently, different learners utilise various approaches in their interpretation and analysis of information or processing of information in order to make it meaningful. In this regard, approaches to learning do not only involve strategies, but also motives. Biggs et al. (2001) argued that students who utilise the deep approach (DA) to learning have a better understanding of processed information than those who do not. In addition, they are intrinsically motivated as well as being capable of deploying strategies that allow them to process meaning from the material to be learned. On the other hand, the students who employ a surface approach (SA) understand knowledge as knowledge reproduction in addition to being extrinsically motivated and using strategies that allow them to reproduce the material learned (Biggs et al. 2001).

Existing research indicates that the effective use of DA to learning produces better academic performance at the higher education level (Duff et al, 2004; Byrne et al, 2002; Zeegers, 2001). In terms of gender, a number of studies have shown that a weaker association exists among female students (Duff et al, 2004; Byrne et al,(2002), but among the older generations, there is a higher score in the use of DA (Zeegers, 2001; Gijbels et al, 2005). Therefore, Gijbels et al. (2005) and Zeegers (2001) argued that older generations are more

motivated and committed to learn using DA in higher education than are younger students. However, Svedin and Bälter (2016) posited that females who prefer to use SA had a superficial understanding of academic disciplines such as science, technology, engineering and mathematics (STEM).

Some studies, however, such as those conducted by Byrne et al. (2002) and Duff et al. (2004) postulated that many students who use DA in their studies tend to perform better in their academic scores than those who do not. In contrast other studies such as those conducted by Gijbels et al. (2005)and Minbashian et al. (2004) show a non-significant relationship between DA to learning and higher academic performance in terms of grades. Minbashian et al. (2004) suggested an explanation for this by stating that the assessment system directly favours those students who employ SA because they usually test conceptual knowledge, thus leading to higher grades for SA learners. According to Beaten et al. (2010), several existing studies have consistently demonstrated that learning approaches significantly impact on the students' academic performance across disciplines, especially in higher education. Duff et al. (2004) thus postulated that choosing of any approach to learning is affected by a number of factors such as contextual factors like learning and teaching activities, personality factors such as age, gender, prior education and academic discipline as well as curriculum content and assessment methods. This is a view supported by Zeegers (2001).

Various inventories have been created in order to evaluate the learning approaches used by students such as the Approaches to Studying Inventory (ASI) as suggested by Ramsden and Entwistle (1981), an approach which was later changed to Revised Approaches to Studying Inventory (RASI) as posited by Tait and Entwistle (1996). Biggs (1978) developed the Study Process Questionnaire (SPQ) that was later changed to Revised Two-Factor Study Process Questionnaire (R-SPQ-2F). The latter approach is made up of 20 items scored on a five-point Likert scale, which categorises students into two groups widely known as DA and SA having four subscales called deep strategy (DS), deep motive (DM), surface strategy (SS) and surface motive (SM) (Biggs et al, 2001).The current study has the following aims:

- To investigate the preferred learning approach of computing students taking the year one Java module; and
- To examine the relationships between students' approaches to learning with regard to entry pathways and their age.

2. Methods

The cross-sectional research was conducted in Singapore's higher education institution. The partakers in the research are undergraduates who specialised their degree in computing. The Java module is obligatory for every learner pursuing computing courses. This research's questionnaire has two parts. The first part concerns the participants' age, entry pathway, gender and year of study while the second part is the R-SPQ-2F (Biggs et al, 2001).

The R-SPQ-2F has 20 items and response was on a 5-point Likert scale ranging from "*always or almost always true of me*" to "*never or only rarely true of me*" It gauges the two approaches; deep and surface. The two scales, DA and SA have two subscales which are strategy and motive. Every subscale contains five items making a total of ten in a study approach. The questionnaire's responses were examined in accordance with the scoring system of Biggs et al. (2001). Both scores of DM and DS were totalled to get each student's DA score. Similarly, SM and SS scores were totalled to get a SA score. 10 was the lowest possible score in both DA and SA while 50 was the highest score attained. In the original tool development of the R-SPQ-2F, Cronbach's alpha values of 0.73 and 0.64 were reported for the deep and surface approaches respectively (Biggs et al, 2001).In this study, Cronbach's alphas were 0.82 for the DA scale and 0.77 for the SA scale. A paper-based questionnaire was administered to the Java module students in their second week of lectures during 2017-2018 academic year.

After collecting the participants' responses, the information collected were quantitatively examined through the use of descriptive statistics comprising standard deviation (SD) and

the average, frequency distribution and percentages, cross tabulations and one-way ANOVA were tested using SPSS 24.0 (IBM Statistical Package of Social Sciences 24.0). According to studies by Biggs et al. (2001)and Shah et al. (2016), R-SPQ-2F was preferred due to its highly reliable coefficients and its goodness of fit.

Ethical guidelines from the British Educational Research Association (2011) and the Singapore Personal Data Protection Act (2012) guided the entire research process. The participants were informed that their participation was voluntary and were assured that data collected would not be disclosed whatsoever, and they could withdraw at any point before, during and even after the research is over.

3. Results

Out of 223 undergraduate students in computing, 186 of them equating to 83.0% of all the students participated in this study. From these partakers, only two questionnaires were incomplete giving a final sample size of 184. Table 1 gives a summary of the respondents.

Table 1: Profile of the Respondents (n=184)

Variables		Number	Percentage
Age	Below 21	47	25.5
	21 and above	137	74.5
Entry pathway	GCE A-level	75	40.8
	Diploma	97	52.7
	Others	12	6.5
Gender	Female	51	27.7
	Male	133	72.3

The participants' average age was 21.45 ± 1.952 years. There were 51 (27.7%) female students and 133 (72.3%) male. According to entry pathway, 40.8% (75 learners) were GCE A-level students, 52.7% (97 students) were polytechnic diploma students and 6.5%, (12 students) were from other levels like Edexcel International, International Baccalaureate (IB) diploma among others.

As demonstrated by Table 2, the value of the mean scores show that the most used learning approach was the DA (M=30.83 ± 6.307). Furthermore, 141 (76.6%) students applied the deep learning approach while only 43 (23.4%) students applied the surface learning approach.

Table 2: Descriptive Statistics of Mean and SDs of R-SPQ-2F (n=184)

Scales and subscales	Mean	SD
Deep motive	14.84	3.501
Deep strategy	15.99	3.466
Deep approach	30.83	6.307
Surface motive	10.32	3.035
Surface strategy	12.43	3.128
Surface approach	22.74	5.521

The two methods of learning were further examined. Table 3 gives the cross tabulation of deep and surface methods of learning scores attained by every student who took part. The scores of every participant were categorised by 10 to 19 being the lowest score group, 20 to 29 representing average score, 30 to 39 representing high score, and lastly very high score were represented by 40 to 50. Furthermore, Figure 1 shows a graphical representation of the scores of DA and SA of every student who participated. The scatter diagram shows that those

found in sector A are attaining scores under the DA average and above the SA average. In square B lower than the average for both DA and SA, square C exceeding the average for both DA and SA, whereas in square D exceeding the average belonging to DA and lower the average of SA. The cross tabulation shown in Table 3 and scatter diagram in Figure 1 provides the data applied in recognising learning approaches of the students.

Table 3: Cross Tabulation of Deep and Surface Approaches to Learning (n=184)

		Deep approach scores				Total
		10-19 (low)	20-29 (moderate)	30-39 (high)	40-50 (very high)	
Surface approach scores	10-19 (low)	2***	10***	30**	9**	51
	20-29 (moderate)	4***	46***	57**	4**	111
	30-39 (high)	1****	12****	8*	1*	22
	40-50 (very high)	0****	0****	0*	0	0
Total		7	68	95	14	184

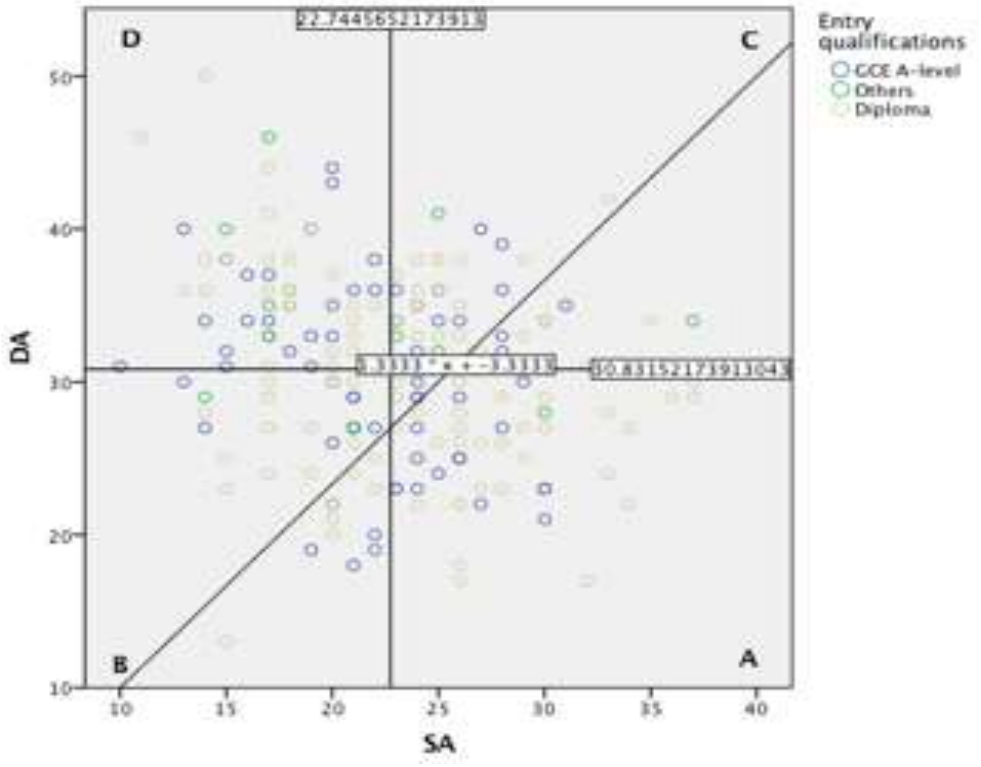

Figure 1: Scatter graph illustrates learning approaches scores for each participant and designated by entry requirements.

Table 3 presents results, which represents the numerical distribution showing that a number of students exhibited high deep learning approach as well as low to moderate surface learning approach when their scores are analysed (N**=100, 54.3%). Those exhibiting low to moderate surface and deep learning approach were (N***=62, 33.7%). However, a few students exhibited high scores for both the surface and deep learning approaches (N*=9, 4.9%). Table III results supports the result demonstrated in Fig. 1 that several students utilise the high scores for DA and low to average scores for SA falling under square D.

Table 4 presented the relationship between age and learning approach variables as determined using independent sample t-tests. The finding showed that there was a statistically insignificant effect of age of a student on the DA score from the scope and size of this study with t (184) = 1.594, where p = 0.113. Moreover, the results of this study also showed that the age of the student did not statistically significantly affect the SA score within the sample and scope of the study, t (184) = 1.761, where p = 0.081 (Table 4).

Table 4: Differences in Learning Approaches Variables Across the Age (n=184)

	Below 21 (*n*=47)		21 and above (*n*=137)		t-value	Sig. (*p*-value)
Variable	**Mean**	**SD**	**Mean**	**SD**		
Deep approach	31.96	5.756	30.45	6.460	1.594	0.113
Surface approach	22.21	5.672	22.93	5.521	1.761	0.081

Note: *p*-value<0.05

Table 5 looks at the results of mean scores for the different entry pathways revealing that the mean scores of all entry pathways deep learning approach is higher than the mean scores of the surface learning approach. Therefore, on average students in all entry pathways employ the deep learning approach more often when studying. In conducting the comparison between the learning approaches variables, the one-way ANOVA test was used for all entry pathways students. In this comparison, the result showed that there were not significant differences in the learning approaches between the different entry requirements with p-value greater than 0.05.

Table 5: Entry Qualification Differences on Learning Approaches Variables (n=184)

	GCE A-level (*n*=75)		Polytechnic diploma (*n*=97)		Others (*n*=12)		F-value	Sig. (*p*-value)
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**		
Deep approach	30.72	5.844	30.46	6.638	34.50	5.617	2.236	0.110
Surface approach	22.11	4.660	23.38	5.929	21.58	6.815	1.418	0.245

Note: *p*-value<0.05

4. Discussion

This study found out that the deep learning approach is the most preferred learning approach by Java module students. This is the expected result because it is eager for computing students to engage in deep learning for them to enhance their computing skills needed for effective mastery of competencies demanded by the profession (Boyle et al, 2002).

This study also found out that age and choice of learning approaches did not have significant relationships with either learning approach. This view is supported by the studies conducted by Duff et al. (2004); Shankar et al. (2006); and Tiwari et al. (2006) in their assertion that no relationship exists between age and learning approaches. However, Yonker (2011) in a study conducted on 56 psychology students between the ages of 18-52 found a contradicting finding that showed a stronger correlation between the two variables (age and learning approaches) as measured by the R-SPQ-2F instrument. This is a finding corroborated by a study conducted by Zeegers (2001) on 227 chemistry students of ages between 17-55, which showed that age has significant effect on learning approaches. The study by Gijbels et al. (2005) on 133 law students also showed that older students had a higher mean DA score as measured by the R-SPQ-2F instrument.

This study also arrived at the same finding as Crawford et al. (1998) that no significant relationship exists between the undergraduate students' entry pathways and learning approaches. Additionally, the studies conducted by Leung et al. (2008) and Fox et al. (2001) arrived at the same finding that SAL remain relatively consistent even when changes affect the learning environment. According to Thomson and Falchikov (1998), several factors and possibilities such as amount of content and pace, learning and teaching strategies are causing the changes in learning approaches after the first year in the university. This is supported by Gordon and Debus (2002) as well as the studies by Georgiou and Sharma (2010) and Ellis et al. (2008) that in addition to the factors mentioned above, the change in students' module causes such changes.

It must be noted that the results of this study may be limited in generalisation due to its small sample size. Moreover, this study recommends further investigation in this field in order to find out more insights in how DA can be used in learning to better academic performance because students pick an approach which has significant impact on their learning as well as academic performance.

Conflict of Interest

No potential conflict of interest relevant to this study was reported.

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