Does the preferred learning style of those training for a career in design and technology differ depending on age?

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Abstract

Many universities now enrol students on their degree programmes from a broad age range with a variety of entry qualifications. This has caused a shift from an elite to a mass higher education system that has affected aspects of teaching and learning. Much research has been carried out into the relationship between preferred learning style (PLS) and effective learning. There is evidence to suggest that a large proportion of those in a specific profession have the same PLS and that there is no overall gender difference in respect of PLS. However, little seems to be known regarding age differences in the PLS of those studying for a given profession,

This paper briefly discusses existing PLS research and explains the choice of tool used to determine the PLS of the sample. It then reports on the findings of a small-scale study of 153 design and technology students (aged between 18 and 54) studying at three different universities in England. The results support the belief that there is a relationship between PLS and specific professions. However, they also indicate that the spread of PLS ratios lessen the older the students become, and that there are differences in PLS in terms of a student's age and gender.

The paper concludes that there are implications for teaching strategies if materials are to meet the needs of all students in mixed aged cohorts even if they are studying for a given profession. The findings would suggest that further research is required to identify ways in which classroom practice could be enhanced as a consequence of the evidence presented in this paper.

Keywords: *learning style, age differences, gender differences, design and technology, higher education, teaching and learning strategies*

Introduction

Individuals learn differently. Many studies carried out during the second half of the twentieth century examined how people preferred to learn (e.g. Biggs & Moore, 1993; Craik & Lockhart, 1972; Entwistle & Ramsden, 1983; Morris & Thomas, 1995). In particular the relationship between preferred learning style (PLS) and effective learning was researched thoroughly (e.g. Davis, 2003; Hlawarty, 2003; Pillay, 1998; Price, 2004; Riding, 2002) whilst the relationship between a teacher's natural teaching style and their own PLS was also given considerable attention (e.g. Evans, 2003; Riding & Read, 1996; Riding, 2002). Learning materials that match the PLS of an individual were shown to be more efficient and effective than materials that were mismatched to PLS (Ford, 1991; Paske & Scott, 1972; Riding & Rayner, 1998). Recent research also indicated that there was no overall gender difference with respect to PLS (Riding & Rayner, 1998). Although other research has shown that a particular profession attracts individuals of a certain PLS (Atkinson 2003a; 2003b; 2004; Riding & Rayner, 1998; Riding & Wheeler, 1995). In the context of this study where students were training for a career in design and technology, these findings would suggest that there would be a large number of individuals, both male and female, with the same preferred learning style for whom one style of learning material would be appropriate.

The shift from an elite to a mass higher education system (Rumble, 1998) has meant that many universities enrol students from a broad age range, rather than recruiting mainly 18-year-old pupils straight from school as they did in the past. Recently concern regarding poor retention and progression rates of these students (e.g. Coffield, Moseley, Hall & Ecclestone, 2004) has added to the debate concerning learning and teaching strategies that cater for this changed student population.

As the relevant research base into cognitive and learning style has grown so have the number of terms used to describe such style groupings. In 2004 Coffield et al identified 71 different models. Recently they and others (e.g. Peterson, Deary & Austin, 2003; Riding, 2003) have provided mixed messages regarding the reliability of many of the instruments devised to categorise individuals into learning style groupings. However there remains considerable agreement that cognitive or learning style is a distinct and consistent way for an individual to encode, store, and perform, and one

that is mainly independent of intelligence (e.g. Biggs & Moore, 1993; Goldstein & Blackman, 1978; Riding & Pearson, 1994; Riding & Rayner 1998). Riding (1991), a major researcher in this field believed that the multiplicity of constructs could be grouped into two principal styles and a number of learning strategies. He referred to these two styles as a 'Wholist/Analytic' family and a 'Verbaliser/Imager' family. From his research he developed a computerised assessment method called the Cognitive Style Analysis (CSA) (Riding, 1991). The Wholist/Analytic dimension he defined as the tendency for individuals to process information in wholes or in parts, while the Verbaliser/Imager dimension he defined as the tendency for individuals to represent information during thinking verbally or pictorially. Because of the nature of design and technology where the ability to manipulate images in the mind (Archer, 1986; Baynes, 1992; Hope, 2000; Lawson, 1990; Potter, 1989), and process ideas as wholes at times and individual details at others are considered valuable skills (Atkinson, 2003b), it seemed appropriate to utilise the CSA to determine the PLS of each person in this study.

Method

Sample

The sample comprised 153 students from three separate UK Universities, all of whom were studying for a design and technology degree. There were 53 students from University X, 33 students from University Y and 67 students from University Z.

Information Gathering Instruments

Preferred Learning Style (PLS). The Cognitive Style Analysis (CSA) was used to determine the PLS of each member of the sample. The CSA data indicated a person's position on both the 'Wholist-Analytic' (WA) and the 'Verbal-Imagery' (VI) dimensions of PLS by means of an independent ratio for each.

Gender and Age

At the beginning of the CSA students were required to enter their gender and age. The maximum age in the sample was 54 the minimum 18. The data concerning age were divided into four bands. Those 19 years old and under were placed in Band A, those between 20 and 29 years old in Band B, those between 30 and 39 years old in Band C and those who were 40 years old and over in Band D. Band A had the narrowest age spread as it only included students who were 18 and 19 years old. Band D had the widest age spread, students in this category were between 40 and 54 years old. It would have been inappropriate to have a Band E for those over 50 years old as only two students fell into this category. These two students were both 54 years old and male.

Results and discussion

Gender

In terms of gender there were 97 males and 56 females. This uneven distribution was expected due to the male dominance found amongst those studying design and technology across higher education in general. However when the gender data were divided into the three universities the gender balance varied from institution to institution. The proportion of males to females in University Y was the closest to that found in the total sample (see Table I). The sample from University Z continued the trend with an even higher proportion of males to females. University X did not conform to this pattern. It was evenly balanced in terms of gender. This anomaly is discussed further in the next section of the paper.

Age

As would be expected in a university population, the greatest number of students was found in the youngest age band and the least in the group of students 40 years and older (see Table 2).

Gender	Total Sample	University X	University Y	University Z
Male	97 63%	26 49%	21 64%	50* 75%
Female	56 34%	27 51%	12 36%	17 25%

* p- value <0.0001

Table I: The gender of the sample in terms of number and percentage split by University

Band	Age Spread	n=
Band A	18 - 20	63
Band B	20 - 29	49
Band C	30 - 39	25
Band D	40 - 54	16

TABLE 2: Age of the total sample split into four age bands

However, like the gender distribution the age spread was not identical across the three universities (see Table 3). University X and Y were both 'new' universities where the recruitment of mature students had been encouraged for many years. It was therefore unsurprising to find that both these universities had a similar broad age spread of 19 to 54. Despite this similarity there were significant differences within that spread. 61% of University X's sample was less than 40 years old whereas only 39% of University Y's sample was in that category. In contrast University Z had a very young population with ages ranging between 18 and 21. This result had been anticipated. University Z was one of the UK's 'old' universities that still mainly recruited students straight from school at 18.

When the data for age and gender were combined it became apparent that there were more similarities than differences between each university. In eight out of the ten groups (illustrated in Table 4) there was the expected larger proportion of males to females. In the two remaining groups this was not the case. In one the very small sample size did not represent a reliable trend and so this result was ignored. Of more significance was the result for the 20–29 age range in University X where there were 22 females in comparison to only 7 males. Unfortunately the data collected did not provide a reason for this significantly large cohort of females that had such a marked affect upon the overall gender results for University X, for if there had been a more even gender distribution in that one age band, University X would also have conformed to the gender pattern found in the other two universities.

Preferred Learning Style (PLS)

The WA ratios of the total sample ranged from 0.470 – 3.480 with a mean of 1.377 (sd=0.554). The VI ratios ranged from 0.720 – 1.610 with a mean of 1.087 (sd= 0.166). The correlation between the two dimensions was 0.086 attesting to the orthogonality of the two dimensions (cf. Riding & Cheema, 1991; Riding & Douglas, 1993). In comparison to Riding's (2000) CSA Standardisation Sample (N=999) the sample in this study did not have subjects at the extremes of the dimensions (see Table 5). This was particularly the case on the VI dimension and significantly so at the Imager end of that dimension. This result was not anticipated, for as already pointed out one might have expected to find some extreme Imagers due to the nature of the activity that the students were studying.

Band	Age Spread	University X		University Y		University Z	
Band A	18 - 20	3	6%	3	9%	57	85%
Band B	20 - 29	29	55%	10	30%	10	15%
Band C	30 - 39	14	26%	11	33%	0	0%
Band D	40 - 54	7	13%	9	27%	0	0%

TABLE 3: The number & percentage of the sample in each age band split by university

Band	Age Spread	University X M	University X F	University Y M	University Y F	University Z M	University Z F
Band A	18 - 20	3	0	1	2	43	14
Band B	20 - 29	7	22	6	4	7	3
Band C	30 - 39	9	5	7	4	0	0
Band D	40 - 54	7	0	7	2	0	0

TABLE 4: The number & percentage of the sample in each age band split by university

Sample	Sample size	Wholist-Analytic	Verbaliser-Imager
Standardisation	999	0.370 – 4.050	0.400 – 5.510
Study	153	0.470 – 3.480	0.720 – 1.610

TABLE 5: A comparison between the PLS ratios found in this study with those of the Standardisation Sample

When the data for the total sample were separated into the four age bands it was found that the mean for each sub-sample remained similar to both the total sample for this study and the standardisation sample. Although an interesting feature of the data was that the spread of PLS ratios on both dimensions lessened the older the students became (see Figure 1).

According to Riding (1991) it is possible to label individuals as belonging to one of three categories on each PLS dimension, although as stated earlier caution is needed in how this information is used. On the WA dimension the labels are Wholist (<1.02), Intermediate at the centre of the dimension (1.03 – 1.35) and Analytic (=>1.36). On the VI dimension the labels are Verbaliser (<0.99), Bimodal at the centre of the dimension (0.99 – 1.09) and Imager (=>1.10). In the standardisation sample there was an even spread in each category (Riding & Rayner, 1998). Within this study the breakdown into these categories was uneven. (See Table 6). This was expected and replicated earlier findings concerning design and technology students (Atkinson, 2003a, 200b; 2004; 2005) and added to Riding and Rayner's (1998) belief that certain styles appear more suited to particular types of profession than others.

In this study there were significantly more Analytics than Wholists on the WA dimension and significantly more Imagers than Verbalisers on the VI dimension (see Table 6) even though, as explained earlier, the Imagers were close to the centre rather than at the extreme of that dimension. On the WA dimension the larger number of Intermediates than expected (statistically the likely number was 46) could also be explained by the type of activity associated with designing, where an ability to fluctuate between seeing the whole of an idea and yet concentrating on the detail of its parts was a skill expected of any designer. Unfortunately the even larger number of Analytics on the same dimension did not add support to this theory nor did the data collected provide an explanation for this phenomenon even though it replicated previous findings concerning design and technology students in higher education (Atkinson, 2003; 2004; 2005).

If the data from both dimensions were amalgamated into a nine cell matrix (see Figure 2) a sample with an even spread between the cells would provide 11.1% of the sample in each cell. Riding and Rayner's (1998) research findings suggested that a percentage of 16 or over in any of the nine cells indicated a relationship between that style and a particular profession. In this

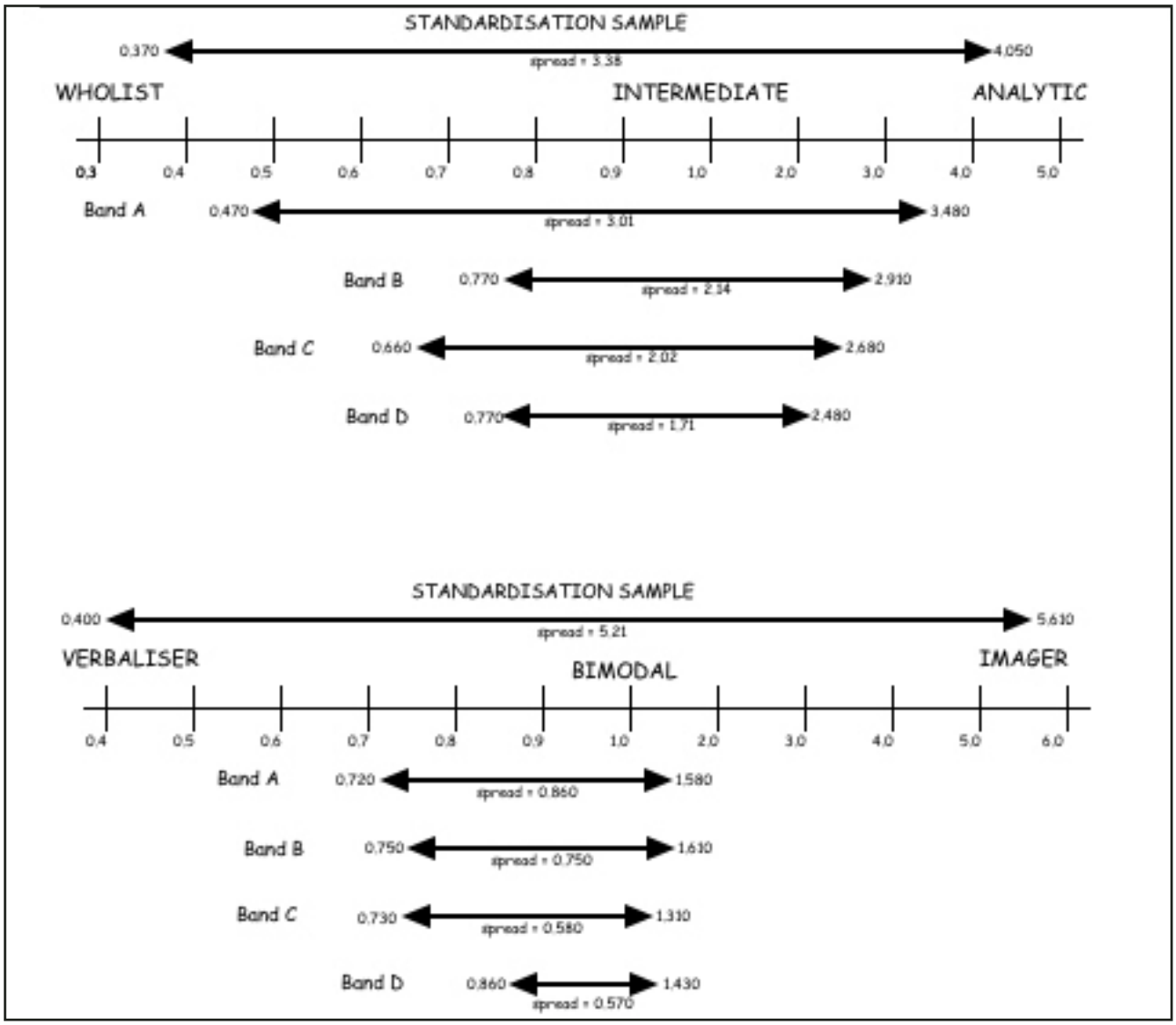

Figure 1: A comparison between the spread of the PLS ratios for the Standardisation Sample and each of the Age Band categories

Sample	Sample size	Wholist	Intermediate	Analytic	Verbaliser	Bimodal	Imager
Total Sample	153	39	53	61*	46	39	68*

TABLE 6: The number of students to be found in each PLS category

Wholist/Verbaliser WV	Intermediate/Verbaliser IV	Analytic /Verbaliser AV
Wholist/Bimodal WB	Intermediate/Bimodal IB	Analytic/Bimodal AB
Wholist/Imager WI	Intermediate/Imager II	Analytic/Imager AI

Figure 2: The nine-cell matrix of PLS

study 18% of the total sample were Analytic Imagers.Unfortunately using the three labels on each dimension and further splitting the data into the four age bands provided some cells with too few students for statistical analysis. Therefore in line with earlier studies (e.g. Atkinson, 1999, 2004, 2005; Borg & Riding, 1993) the data in the central cell on each dimension were split equally into the data sets on each side. This provided two categories per dimension, Wholists and Analytics on one dimension and Verbalisers and Imagers on the other. This gave a four-cell matrix (see Figure 3), with adequate numbers of students in each cell enabling analysis of the differences between students of different ages and PLS to be scrutinised.

Wholist/Verbaliser WV	Intermediate/Verbaliser IV
Wholist/Imager WI	Analytic/Imager AI

Figure 3: The compact four-cell matrix of PLS

In Band A most students were found in the WV category (see Table 7) even though there were significantly less Wholists and Verbalisers in the total sample. In Band B most students were found in the AI category. Band C results partially repeated the results of Band B in that Analytics were once again more frequent than Wholists. However, in this instance Analytics were split equally between Imagers and Verbalisers. In Band D Analytics continued to dominate and the swing on the other dimension from Imager to Verbaliser was also evident.

Before any conclusions could be made it was decided to check the consistency of these findings across universities (see Table VIII). With regard to Band A, in both University X and Y the largest number of students was found in the WI PLS, whereas in University Z most students were found in the WV category. As 90% of students in this age band were from University Z this result significantly influenced the total sample result for this age band. However it should be noted that there was consistency in one dimension across all universities in that Wholists dominated in each case. In Band B there was consistency across all universities in that AI was the most common PLS category. In Band C and D the comparison was only between University X and Y as there were no students in University Z in these age bands. In Band C both universities were the same, the AI and AV category of PLS had an equally large number of students in them. In Band D most students were in the AV category.

These results would suggest that the PLS of design and technology students does differ depending upon age. It would also appear that the change is not the same on the two dimensions. On the WA dimension the linear change from Wholist to Analytic happened abruptly at 21. On the VI dimension there was an arched relationship between age and PLS. For students under 20 the most common PLS was Verbaliser, between 20 and 29 it was Imager, 30 to 39 it was evenly spread between Imager and Verbaliser and for those 40 and over it was once again Verbaliser. However, when the three universities were viewed separately it was University Z with 90% of those younger than 20 in the total sample that influenced the result. If University Z was removed from the equation there was a linear relationship with a gradual movement from one end of the dimension to the other the older the students became.

When gender data was added to the equation the data on the WA dimension suggested more gender similarities than differences adding support to Riding and Rayner's findings (1998) referred to earlier in this paper. There were more male Analytics than male Wholists in every age band

Band	WV		AV		WI		AI		Total
Band A	19	30%	15	24%	16	25%	13	20%	63
Band B	3	6%	13	27%	10	20%	23	47%	49
Band C	4	16%	8	32%	5	20%	8	32%	25
Band D	4	25%	6	37%	3	19%	3	19%	16

TABLE 7: The number and percentage of the sample in each PLS category split by age band

Band	University X	University Y	University Z	Total Sample
Band A	WI	WI	WV	WV
Band B	AI	AI	AI	AI
Band C	AI/AV	AI/AV	AI/AV	AI/AV
Band D	AV	AV	-	AV

TABLE 8: The number and percentage of the sample in each PLS category split by age band

with females following this pattern in all except the youngest age band where 75% of females were Wholists. On the VI dimension the gender results were not consistent and therefore did not support Riding and Rayner's (1998) findings. There were more male Verbalisers than male Imagers in the youngest and oldest age bands and more male Imagers than male Verbalisers in the middle two age bands. Females did not follow this pattern. There were a greater number of Imagers in the oldest and second youngest age band, an equal number of Imagers and Verbalisers in the very youngest age band and a high number of Verbalisers in the second oldest age band.

Conclusion

Research has indicated that learners learn best using materials matched to their PLS and that there is a tendency for teachers to reflect their own PLS in their teaching style and teaching materials. Previous research has also suggested that where students are training for a specific profession that a large proportion of the cohort would have the same PLS. In this instance this proved to be the case with a larger than statistically expected number of the sample being Analytic Imagers. However when the age of the sample was taken into account then there was a tendency for the most common PLS to move from one end of a dimension to the other as age increased. It was also the case that the ratio spread on each dimension decreased as the age of the students increased suggesting that individuals had less extreme positions on the two dimensions of PLS the older they became. Research would suggest that these students would be more able to cope with learning materials that were mismatched to their PLS. The gender data did not adequately support earlier studies regarding gender similarities with respect to PLS particularly on the VI dimension and that this too would be likely to affect the match between learning materials and PLS.

The results of this study would suggest that if design and technology tutors are producing learning materials which match their own PLS which has been influenced by their age and belonging to a specific profession, that these materials will not necessarily be appropriate for all their students, particularly young students whose PLS is at the extreme opposite end of the two dimensions compared to mature students nearer the centre of each dimension. These findings would suggest that further research is now required to test this theory out within a classroom environment by designing a variety of materials to meet the PLS needs of all students no matter what age or gender.

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