Cognitive Style and Cross Cultural Differences in Internet Use and Computer Attitudes

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Abstract

One of the challenges facing instructional designers is in producing e-learning systems, which take account of individual differences such as nationality, gender and more importantly from an educational perspective, cognitive learning style. Accordingly, it would seem pertinent to investigate such individual difference factors with respect to computer use generally, as a means of informing e-learning instructional design. 170 undergraduate students (103 Chinese and 67 UK) completed the Cognitive Styles Index (Allinson and Hayes, 1996), a computer attitude scale (Smalley, Graff and Saunders, 2001), and also a questionnaire on their knowledge of the Internet and how effectively they used the Internet. The results revealed that Chinese students displayed a more favourable behavioural attitude than the UK students. Also, Chinese participants reported higher Internet usage than UK participants. Nationality also interacted with age on attitude scores, with the greatest variation between age groups in the Chinese sample. The results are discussed in terms of the implications of this research for the design of e-learning systems.

Key Words

Cognitive style, computer attitudes, Internet use, cross-culture

Introduction

Despite the theoretical benefits that e-learning systems can offer, difficulties can often occur when systems are not designed with consideration to learner characteristics. Such differences between learners may be defined in terms of nationality, gender, and cognitive learning style (Freedman and Liu, 1996; Liang and McQueen, 1999).

It is also theoretically possible that individual differences may occur cross-culturally because of differences in cognitive learning style between individuals from different cultures and this issue of cross-cultural differences in learning style has been greatly debated over recent years. For example, some authors have asserted that cognitive style and culture may not be related (for example Kubes, 1998) whilst others have asserted that there are cross-national differences in cognitive style. For example Allinson and Hayes (2000) found that managers in North European and Latin cultures were more intuitive than their counterparts in developing countries and Arab countries. Furthermore, at secondary and tertiary levels there is research evidence to suggest that East Asian learners, exhibit more effective learning styles and academic performance than their western counterparts (Biggs 1991, Watkins and Regmi 1990, Kember and Gow 1991). One possible explanation to account for these differences in learning style may be the differences in approaches to studying between cultural groups. Indeed, Smith (2000) reported such differences between Australian and Chinese University students, using Ramsden and Entwistle's (1983) Approaches to Studying Inventory (ASI). Furthermore, Turner (2000) assessed the learning approaches of students from the People's Republic of China studying at degree level both in the UK and in a UK-franchised degree programme in Beijing and concluded that students from China approach learning in the UK system with a culturally different learning style from that of British-educated students. Accordingly, differences in cognitive style may contribute to the way in which a learner approaches and engages with e-learning.

With respect to gender Riding (2000) reports that in terms of the analytic-wholist cognitive style (similar to the analysts-intuitive cognitive style), differences tend to be small and non-significant. However, he also suggests that males tend to be slightly more analytic than females.

Overall then, it would appear to be useful to approach an exploration of individual differences in computer use for instruction, by looking at three major factors, namely nationality, gender, and cognitive learning style.

Attitudes to computer-assisted learning

One way of assessing an individual's approach to computer use for instruction is by testing an individual's attitudes to this. Over the last decade, numerous studies have explored individual differences in attitudes towards computers. For example, differences have been noted between attitudes to computer assisted learning and personality factors, (Francis, Katz and Evans (1996), self-image and locus of control (Woodrow, 1990; Katz, 1994) and risk-taking (Offir and Katz, 1990). Furthermore, Abouserie, Moss & Barasi, (1992) noted that male students preferred using computers in their learning than females.

Accordingly, further exploration of individual differences in attitudes towards computers for instruction may reveal different approaches to computer use between different types of learners. Therefore, this study therefore seeks to investigate individual differences in approaches to using computers between gender, nationality and between individuals displaying different cognitive learning styles.

Method

Participants

A sample of 170 undergraduate students was employed for this study. These were 103 Chinese students studying in China (mean age 20.23, SD 1.52) and 67 British students studying in the UK (mean age 20.78, SD 2.60). The mean age for all participants was 20.45 with an SD of 2.03. For participants overall, there were 37 males and 129 females with 4 not recorded.

Instruments

a. Computer attitude scale

Attitudes to using computers were assessed using the Jones and Clarke (1994) computer attitude scale for secondary students. This instrument consists of three subscales, which assess affective, behavioural, and cognitive components of a respondent's attitudes. This scale was revised and updated by Smalley, Graff and Saunders (2001) and using a sample of 146 respondents, yielded Cronbach alphas for each attitude subscale of 0.88 (affective), 0.74 (behavioural), 0.88 (cognitive) and 0.91 (total). Test-retest reliability of the revised scale is deemed to be satisfactory ($r = 0.84$, $p < 0.001$). The theoretical maximum and minimum possible scores on this scale are 37 and 185 with higher scores indicating more negative attitudes towards computers and lower scores indicating more positive attitudes. In this study respondents' scores ranged between 43 and 151, inclusively (mean 86.42, SD 18.57).

b. Cognitive styles index (Allinson and Hayes 1996)

The Cognitive Styles Index (CSI) (Allinson and Hayes 1996) is a self-report test designed to measure the whole/part-processing dimension of cognitive style. The instrument contains 38 statements, to each of which a respondent must indicate a true/uncertain/false response. The test identifies an individual's cognitive style as being either analyst or intuitive. The term intuitive is used to describe an individual who makes judgements based on feelings and who adopts a global approach to processing information, whereas the term analytic describes an individual who makes judgements based on reason, and who focuses on specific detail when processing information. The CSI has a theoretical maximum score of 76. Higher scores indicate a more intuitive cognitive style and lower scores indicate a more analytics style. The psychometric properties of this instrument are documented in Allinson and Hayes (1996), who report test-retest reliability of the instrument at ($r = 0.90$, $p < 0.001$). They furthermore report the internal consistency scores measured by Cronbach's alpha to range from 0.84 to 0.92. The minimum and maximum possible scores on this instrument are 0 and 76.

c. Questionnaire

The questionnaire used in this study consisted of 18 questions. The first part of the questionnaire measured Internet knowledge, with questions such as 'name four search engines?' The maximum and minimum scores on the knowledge part of the questionnaire were 0 and 16 respectively. In this study, the range and mean of participant scores for Internet knowledge were 16 and 4.88, respectively.

The second part of the questionnaire asked for information such as how easily respondents reported they were able to find information using the Internet and whether they became lost, distracted or frustrated when doing so. A high score on this scale indicated high ease of use whereas a low score indicated low ease of use. The ease of use scale scores ranged from 8 to 40. In this study, the ease of use scale scores ranged between 11 and 27, inclusively, with a mean of 19.56.

The final question on the questionnaire asked participants to estimate the number of hours per week (Hrs.p.w) they used the Internet.

Procedure

The general design of this study involved a comparison of computer attitudes, Internet knowledge and ease of use between students with different cognitive styles and between students from the UK and China. Data collection simply involved completion of test instruments and questionnaires by students during a class.

Results

1. Differences in computer attitude scores Internet knowledge and ease of use scores for cognitive style and gender

For the purpose of data analysis, participants scoring in the lowest 25% and highest 25% on the CSI were labelled as 'analysts' and 'intuitives', respectively. Table 1 shows the means and standard deviations for cognitive style and gender on computer attitude scores. Table 2 shows the means and standard deviations for cognitive style and gender for Internet knowledge and ease and hours of use scores.

Table 1. Computer Attitude Scores for Cognitive style and gender

Cognitive style	Gender	Overall	Affective	Behavioural	Cognitive
Analyst	Male	72.75 (19.06)	29.25 (6.39)	24.25 (7.97)	22.25 (4.85)
	Female	85.03 (17.84)	36.40 (8.63)	25.46 (4.64)	24.71 (5.46)
	All	83.66 (18.12)	35.61 (8.64)	25.33 (4.96)	24.44 (5.39)
Intuitive	Male	94.70 (24.51)	40.80 (9.84)	26.30 (5.33)	29.20 (8.84)
	Female	90.39 (17.72)	38.88 (9.07)	27.02 (4.78)	26.13 (5.21)
	All	91.32 (19.17)	39.30 (9.16)	28.86 (4.86)	26.80 (6.19)
All	Male	88.42 (24.61)	37.50 (10.28)	25.71 (5.94)	27.21 (8.37)
	Female	87.86 (17.85)	37.72 (8.89)	26.29 (4.75)	25.47 (5.34)

Table 2. Internet Knowledge, Ease of Use and Hours Use for Cognitive Style and Gender

Cognitive style	Gender	Knowledge	Ease of use	Hours use

Analyst	Male	3.25 (3.86)	20.00 (1.41)	3.12 (2.17)
	Female	4.62 (2.77)	19.62 (3.28)	4.82 (4.01)
	All	4.47 (2.88)	19.66 (3.12)	4.63 (3.86)
Intuitive	Male	4.20 (3.04)	18.40 (3.40)	9.75 (11.55)
	Female	4.44 (3.34)	19.61 (2.67)	6.13 (4.00)
	All	4.39 (3.24)	19.34 (2.85)	6.92 (6.34)
All	Male	3.92 (3.17)	18.85 (3.00)	7.85 (10.15)
	Female	4.52 (3.06)	19.61 (2.95)	5.51 (4.03)

A two way multivariate ANOVA was calculated to examine the effects of cognitive style and gender on computer attitude scores (CAS) and Internet knowledge, ease and hours of use scores.

A significant main effect of cognitive style was noted for Internet use ($F_{1,78} = 5.28$, $p < 0.05$). An analysis of the means reveals that participants with an intuitive cognitive style had greater self-reported Internet use than those with an analytic cognitive style, means 6.92 Hrs.p.w. and 4.63 Hrs.p.w., respectively.

There was also a significant main effect of cognitive style on computer attitude scores ($F_{1,78} = 5.20$, $p < 0.05$). This effect was such that intuitives had a higher mean CAS score than analysts, 91.32 compared to 83.66. Therefore, participants with an analytic cognitive style demonstrated more positive attitudes towards computers. There was also a significant effect on the affective and cognitive CAS subscales ($F_{1,78} = 6.07$ and 5.04, respectively, $p < 0.05$), such that analytics demonstrated more positive affective and cognitive attitudes to computers.

No effects were noted for gender or the interaction between gender and cognitive style.

2. Differences in computer attitude scores Internet knowledge and ease of use scores for nationality and age

For the purpose of analysing the data, participants were divided into three age groups of 17-19 years (N=42), 20 years (N=68) and 21-32 years (N=57) respectively.

Table 3 shows the means and standard deviations for nationality and age on computer attitude scores.

Table 3. Computer Attitude Scores for Culture and Age

Nationality	Age band	Tot Attitude	Affective	Behavioural	Cognitive
UK	17-19 years	84.23 (18.56)	34.57 (9.03)	26.90 (4.82)	25.23 (5.35)
	20 years	99.43 (19.70)	41.62 (11.17)	30.06 (4.52)	28.12 (5.31)
	21-32 years	83.57 (23.62)	35.15 (10.66)	25.30 (6.37)	25.19 (7.49)
	All	87.82 (21.83)	36.60 (10.54)	27.04 (5.69)	25.95 (6.35)
China	17-19 years	79.06 (10.80)	34.50 (5.12)	24.68 (3.78)	21.87 (4.16)
	20 years	81.56 (14.78)	36.68 (7.03)	23.47 (4.76)	23.54 (4.83)
	21-32 years	95.44 (17.55)	42.34 (7.66)	25.79 (5.12)	28.48 (5.85)
	All	85.64 (16.51)	38.13 (7.53)	24.44 (4.79)	24.85 (5.66)
All	17-19 years	82.00 (15.71)	34.54 (7.50)	25.94 (4.49)	23.78 (5.09)
	20 years	86.33 (17.93)	38.00 (8.54)	25.23 (5.51)	24.76 (5.33)
	21-32 years	89.83 (21.30)	38.94 (9.81)	25.56 (5.70)	26.92 (6.82)

Table 4 shows the means and standard deviations for nationality and age for Internet knowledge and ease and hours of use scores.

Table 4. Internet Knowledge, Ease of Use and Hours Use for Culture and Age

Nationality	Age band	Knowledge	Ease of use	Hours use
UK	17-19 years	5.76 (2.23)	20.91 (1.10)	4.57 (2.36)
	20 years	4.00 (4.06)	18.25 (1.56)	3.37 (2.58)
	21-32 years	4.96 (2.99)	21.70 (1.06)	6.38 (5.05)
	All	4.95 (3.11)	19.46 (3.34)	5.01 (3.92)
China	17-19 years	4.81 (2.40)	20.08 (1.21)	5.82 (3.47)

	20 years	4.93 (3.28)	19.98 (0.91)	8.81 (8.40)
	21-32 years	4.51 (3.12)	17.39 (0.97)	7.92 (6.74)
	All	4.77 (3.06)	19.62 (2.97)	7.98 (7.22)
All	17-19 years	5.37 (2.26)	19.57 (2.92)	5.11 (2.92)
	20 years	4.78 (3.47)	19.28 (3.07)	7.36 (7.68)
	21-32 years	4.68 (2.97)	19.86 (3.30)	7.19 (6.01)

A two way multivariate ANOVA was calculated to examine the effects of nationality and age on computer attitude scores (CAS), Internet knowledge, ease and hours of scores and scores for cognitive style.

There was no significant main effect of nationality on overall computer attitude scores, however there was a significant main effect on the behavioural component of CAS scores ($F_{1,146} = 10.13$, $p < 0.01$). An analysis of the means reveals that Chinese participants had significantly lower behavioural attitude scores than UK participants, means of 24.44 and 27.04, respectively. Therefore, the Chinese participants had a more positive behavioural attitude towards computers.

There was no main effect of age on the overall CAS scores, however there was a significant effect on the affective and cognitive components ($F_{2,14} = 3.62$ and 3.75, respectively, $p < 0.05$). Tukey post hoc tests revealed that scores for participants aged 17-19yrs significantly varied from scores for participants aged 21-32yrs. An analysis of the means reveals that the lowest age band had significantly lower scores on the affective and cognitive attitude subscales than the highest age band (mean affective 34.54 and 38.00, mean cognitive 23.78 and 26.92, respectively). Therefore, the 17-19 yrs age group had significantly more positive affective and cognitive attitudes towards computers.

A significant interaction effect between nationality and age on the overall CAS score was also noted ($F_{2,146} = 8.91$, $p < 0.001$). The mean difference between the highest and lowest age bands was significantly greater in the Chinese sample than the UK sample.

There was a significant main effect of nationality on self-reported Internet use ($F_{1,146} = 6.91$, $p = 0.01$). An analysis of the means revealed that Chinese participants reported significantly higher Internet use than UK participants, means of 7.98 Hrs.p.w. and 5.01 Hrs.p.w., respectively.

Discussion

The aim of this study was to investigate individual differences in approaches to using computers between nationality, gender, and between individuals displaying different cognitive learning styles.

1. Differences between cognitive styles and gender

The findings of this study firstly illustrate that analysts report a more favourable attitude to computer-based learning than intuitives. Furthermore, when the attitude scale is analysed in terms of its subsections, significant effects are observed for the affective and cognitive subscales, again with analysts reporting more positive affective and cognitive attitudes towards computer-based learning than intuitives.

However, when the results for time spent using the Internet are assessed, intuitives report greater Internet use than analysts. Typically intuitives are more socially orientated than analysts and therefore this result is perplexing, as its seems to indicate that intutives spend more time in engaged in isolating computer activity. Accordingly, what is required from further research is an analysis of which particular computer-based activities analysts and intuitives engage, for example more isolating web-based searching and browsing for information or activities such as Internet based interaction with others.

2. Differences for nationality and age

This study did not reveal any differences between UK and Chinese students' overall attitudes towards computer-based learning, however, a differences was observed between these two groups on the behavioural attitude component, where Chinese students had significantly more positive behavioural attitudes towards computers than UK students. The practical implications of this finding for educational initiatives would be to attempt to change the attitudes of the UK students.

The results also indicate a difference in the affective and cognitive components of attitudes between different age groups, such that the younger age group (17-19yrs) reported more positive attitudes than the older age group (21-32yrs). It is possible that this may relate to differences in education and exposure to the Internet and is worthy of further research.

With respect to nationality and age, the results indicated an interaction such that there was a greater mean difference between age groups in the Chinese sample. Further in-depth exploration into the cause of these cultural and age related differences would reveal the factors, which encourage more positive attitudes.

Finally, this study also found a difference in self-reported Internet use between UK and Chinese students, with the Chinese students reporting greater use. However, no differences between UK and Chinese students were found for Internet knowledge or ease of use scores.

Conclusion

Overall, the above findings suggest that individual differences are evident in terms of attitudes to computer-based learning and Internet use and that these differences exist principally on two levels, which are nationality and cognitive learning style. Accordingly, it is suggested that future design of web-based and computer-assisted learning systems need to take account of these differences. In other words, where individual differences exist, and where such differences may affect attitudes, it is suggested that education should be aimed at tailoring initiatives according to an individual's learning style.

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