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ORIGINAL ARTICLE

The effect of language background on teaching and learning in the master of pharmacy degree

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Abstract
Previous studies in Hungary and Japan have indicated a strong link between language and requirements for pharmacy and biomedical teaching. The effect of first language on scientific comprehension was assessed on full-time, undergraduate Master of Pharmacy students from all four years of study at the University of Brighton. This was achieved by the use of a language quiz, which was scored for comprehension of parts of scientific words. Students with English as their native language scored significantly higher than others (medians 45, 20%, respectively; $p < 0.001$). Scores of native English speakers improved with age and year of study, but these trends were not seen for others. Students who had studied Latin obtained significantly higher test scores (medians 60, 45%; $p = 0.006$). Students whose parental language was English or European scored significantly better than others (medians 9,7,5 out of 20%; $p < 0.001$).

Keywords: *Greek, language, Latin, MPharm, second-language acquisition, Widening Participation*

Introduction

Current medical and scientific terminologies traditionally have their origins in the Latin and Greek languages. English medical terminology developed from Medieval Latin terminology, which had absorbed a developed Greek terminology (Dzuganova, 2002). The Classics are no longer taught in the UK state education system, therefore students may no longer have knowledge of the basic lexemes of which scientific meta-language is composed. It may therefore be advantageous for those undergoing scientific or biomedical training to undergo further training in the basic elements of Greek and Latin, particularly for those students whose first language is not of European origin (that is, a member of the larger Indo-European family of related languages and dialects, found mostly in Europe but also in parts of western Asia). In an increasingly multicultural society, and with the extension of the European Community allowing increased freedom of movement and employment for health professionals from across the continent to work in the United Kingdom's National Health Service (NHS), it was felt that the issue of specialist medical, biomedical and pharmaceutical language was one which needed to be addressed—specifically, in this instance, in the context of teaching and learning in the UK Master of Pharmacy (MPharm) degree pathway.

One of the key skills a pharmacist must have is the ability to communicate effectively with patients in a range of clinical environments. The development

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of communication skills, including oral and written language skills, has changed significantly in the MPharm in recent years. This perhaps reflects the wider changes in education, with a greater range of delivery modes and the use of blended learning techniques becoming increasingly commonplace. Surratt (2006) explored the adoption of "traditional" graduate seminars into a more structured learning environment, where written and oral communication skills were emphasised. Students presented both formal and informal seminars on the progress of their research and on recent advances in literature relevant to their subject. This was also an issue addressed by Kenagy and Stein (2001), who focused on the issue of medical errors associated with naming, labelling and packaging of pharmaceutical products. The authors suggested that the intensive focus of their course, particularly group and individual intensive coaching and feedback sessions, highlighted the development of oral and written language skills, and that such key skills are important as they allow the increasing number of students whose first language is not English to develop essential communication skills. Such errors have been made due to confusion regarding, for example, similar drug names, and that drug names, labelling and packaging requirements may not necessarily be selected in a way that considers the communication skills of the pharmacist.

Therefore, an understanding of language ability—and the breadth of languages spoken by students undertaking the UK MPharm degree—is essential in developing appropriate educational tools that do not exclude students. Linguistic ability, particularly its range, should be viewed as a positive aspect. This is particularly important, where such skills reflect the cultural diversity of patients that the pharmacist will advise (Schaafsma, Raynor, & deJong-van den Berg, 2003; Shaya & Gbarayor, 2006). The breadth of language ability and communication skills is therefore positive, and as such its role in the MPharm should be addressed and optimised where possible.

Learning behaviour is influenced by many factors, including student approaches to learning and the approach to curriculum design and delivery (Miranda, Bates, & Duggan, 2002). Austin and Dean (2004) described a study in Canada which indicated that pharmacists trained overseas were more frequently cited for the incorrect interpretation of prescriptions and practice-related errors that led to patient harm. They detailed case reports relating to issues of communication and showed that, while most overseas-trained pharmacists practicing in Canada possess a high degree of pharmaceutical and biomedical knowledge, they have great difficulty in transferring this into the Canadian clinical context. Austin and Dean (2004) also discussed the provision of a course—English for specific purposes—for non-native English speakers. This course was designed to specifically allow the learner to develop key skills related to a particular field. For example, the differences in similar-sounding words (e.g. *heart* and *hard*), including drug names or brand names (e.g. *Lasix* and *Losec*), was addressed.

More subtle than, for example, second-language acquisition, is the idiomatic variation underlying languages (Ingram et al., 2004). Idioms provide a challenge for native speakers of a language as well as those acquiring a new language. The differences in English spoken in the UK, the USA or Australia, highlights the challenges of language acquisition and its impact upon learning and teaching. Language is constantly changing and developing—this is particularly evident due to the inclusion of new words, possibly with multiple or revised meanings, when dictionaries are continually updated. The development of communication skills in the MPharm has changed significantly in recent years and is reflected in the range of teaching modes employed (see Borrego et al., 2000; McDonough & Bennett, 2006; Surratt, 2006). Understanding the specialist language or technical terminology of any discipline is, of course, essential to a successful career in that, or possibly a related, discipline.

The effect that a lack of specific language knowledge can have has been highlighted by Selbst, Levine, Mull, Bradford, and Friedman (2004) in the field of emergency paediatric care. They described situations where clinical paediatric care was potentially compromised by a language barrier in certain parts of the United States, usually but not exclusively in areas where English and Spanish are spoken. Indeed, Benjamin (2003) suggested that proper use and understanding of language, both from political and linguistic backgrounds, could help significantly in the reduction of medication errors, along with classical pharmacological interventions, that is, "the five rights": the right drug, right dose, right route, right time, and right patient.

A further important issue in the UK is the Widening Participation agenda, and how it relates to pharmacy and biomedical sciences in particular. The pharmacist has to address the needs of his or her community, and in an increasingly multicultural society language plays an important role, particularly where patients might not be fluent in the English language, or where those being educated do not have English as a first language. This specific issue has been addressed by Antal, Matyus, Marton, and Vincze (2002). They describe the establishment of a pharmacy degree course in Hungary. The Hungarian language is, in European terms, quite unusual in that it is not related to any other common European language groups, and does not have a Greek or Latin basis. The Hungarian language (Magyar) belongs to the Ugrian group of the Finno–Ugrian languages and is related to Finnish and Estonian, and has grammatical similarities to Turkish

and Kazah languages. Therefore, Antal and his colleagues established a pharmacy course in Hungary that contained a core, compulsory, 60 h of Latin. This was focused at the beginning of the course. The aim of this was to familiarise the students with the terminology that they would encounter when using specific scientific and medical terminology, most of which is derived from classical European languages and which is absent from Magyar. This issue has also been addressed by Uchibayashi (2003), who has reviewed the Indo-European roots of the languages used to construct pharmaceutical terminology. This article highlights the issues of students from non-Indo-European language groups studying pharmacy (and working in the pharmacy sphere) in a global economy dominated by pharmaceutical companies who are predominately from the USA, the UK and mainland Europe.

Therefore, the aim of this study is to attempt to understand, through the use of a quantitative assessment of language ability, how a student's linguistic background may influence or affect learning outcomes for pharmacy students. By extension, this is a study which may impact upon the learning and teaching of other biomedical science students.

Methods

The study was carried out at the School of Pharmacy, University of Brighton. All information given to full-time MPharm students was approved by the university ethics committee. All data collection was anonymous. Students in all four years of the MPharm degree at the University of Brighton were given the "language test" and asked to complete it. This was undertaken at a regular timetabled teaching events for each cohort of MPharm students. The students were provided with a questionnaire of the following format: Section 1, a brief written introduction which explained what the purpose of the test was; Section 2, a page where demographic information could be recorded; and Section 3, which contained a brief questionnaire and the language test. The demographic information contained normal information regarding students' background (see Ingram et al., 2004) and also asked for information about the student's use of language, specifically: gender; age (by group); year of study; nationality; place of birth; length of time resident in the UK, if not born there; where nursery, primary and secondary education was completed, and in which language; had the participant completed a degree outside the UK; were Greek or Latin, or both, studied at school; language(s) spoken at home, and by the participant's parents; which language they consider to be their first language, and their parents first language. This was completed as a group, and all four student cohorts were sampled over a two-day period in their respective groups.

The third section of the questionnaire is the most important to this study. It contains the "language quiz", where terms commonly encountered in pharmacological and/or biomedical environments were listed. The students were asked to describe the meaning of each *part* of the word. The word *hydrolysis* was given as an example, and was split into its constituent parts (e.g. *hydro-*, water and *lysis*, split) in order to guide the student in completing the test. This was also explained in a briefing given to the students by members of the research team. The following words were chosen for this pilot test: antenatal; dyslipidaemia; cytomegalovirus; uricosuric; thrombolytics; hypoxaemia; iatrogenic; hydroencephaly; postherpetic. These words break down into twenty parts, and as such the test was scored out of a total of twenty. Where appropriate, focus groups were employed to probe further students' habits and attitudes towards language use in their course of study. The test was given to all students in lectures and a return of 66% was considered to be a minimum response from those students who attended the given lecture. All tests were double-marked and a sample were further moderated and checked—two databases were compiled independently for validation purposes. Responses to the test, including demographic information, was analysed by SPSS® v.14. When analysing the difference between two categories the Mann–Whitney U test was used (analogous to a t-test) due to the distribution subsets in the data (that is, those students who have studied Latin, compared to those who have not). This was normally assessed by a p-value of less than 0.05 being returned in upon analysis by the Anderson–Darling normality test. In all other situations Kruskall–Wallis (analogous to ANOVA) was used.

Results

The distribution of scores was non-Gaussian (Anderson–Darling $A = 2.37$; $p < 0.005$) and skewed in favour of the lower scores (kurtosis $= -0.95$). Both, mean (36.3%) and median (37.5%) values are the below pass mark in most examinations. 13% of students scored zero. All subsets of the data examined showed non-Gaussian distribution, so non-parametric tests were used for all subsequent analyses.

Effect of first language

The major separation of scores was between students who had English as their first language (median score 9) and those who did not (median 4). The Mann–Whitney W statistic ($W = 24194$) shows the difference is significant at $p = 0.0005$. 12.2% of students whose first language is English scored zero, compared with 31.3% for others. All subsequent analyses were therefore performed on these two groups separately.

Effect of gender

Median scores were 8 (Male) and 9 (Female) for English first language, and 2 (Male) and 5 (Female) for others. The Mann–Whitney statistic, $W = 2602$ (English) and 642 (others) showed these differences were not significant at $p = 0.05$ for both groups (Table I).

Effect of age

There appears to be a trend (Table I) for increasing test scores with age for those with English as a first language (Kruskal–Wallis $H = 22.41$; $p < 0.0001$). The Mann–Whitney test showed that the most significant differences were between the lowest age group and the others. Median values and p-values for pair-wise comparisons are shown in Table IIa (first language English only). For others the Kruskal–Wallis test showed no age effect ($H = 0.55$; $p = 0.76$).

Effect of year of study

This is potentially more significant than physical age as it might reflect increasing ability on exposure to the course. A Kruskal–Wallis test ($H = 24.6$; Table I) showed that significant ($p < 0.001$) differences existed amongst the age groups for First language English students and the *post hoc* Mann–Whitney pairwise comparisons (Table IIb) test showed significant differences between the earlier and later years. No difference was shown at $p = 0.05$ amongst the age groups for other students (Table I; $H = 6.16$, $p = 0.104$).

Effect of study of Latin

This is limited to first language English students as only two of the others had studied Latin. Those who had studied Latin had a median value of 12 compared with 9 for those that had not. The difference is significant at $p = 0.0059$ (Mann–Whitney $W = 2926$; Table I).

Effect of language spoken at home

The Kruskal–Wallis test ($H = 24.8$) showed significant ($p < 0.001$) differences amongst the five groups (Table I). *Post hoc* pairwise comparisons of the median scores (Table IIc) showed no difference between homes where English (median 9.0) or English plus a European language (median 8.5) but students from an exclusively English speaking home scored significantly ($p < 0.05$) higher than the other three groups.

Effect of parental first language

As expected this reflects the Home Language situation. Students whose parents spoke English (median 9) or another European language (median 7) scored significantly higher than those whose parents spoke a non-European language (median 5; Kruskal–Wallis $H = 22.8$, $p = 0.001$; Tables I and IId). No significant differences were found with regard to nursery education.

Another issue was the "depth" of education received by participants in this study. Students who attended nursery school in an English-language or other European language-based environment scored significantly higher in the test than those who were not educated in this manner ($p = 0.044$). However, no discernable trends were observed for primary or secondary education ($p = 0.20$). This is possibly due to reasons explored by Fitzgerald, Finch, Blake, Perry, and Bell (2002), who found that participation in early schooling was influenced by ethnic backgrounds. Also of significance was the language spoken at home by the participant's parents (Table IIc). Where these languages were not of Indo-European origin, significantly lower scores were found ($p = 0.001$). This is mirrored closely with the first language of participant's parents (Table IId). Another significant factor relates to the students' perception of their own first language—students who perceive that English is their first language scored significantly higher than those who did not (Table I).

Participant habits and attitudes were addressed through the questionnaire component of the study. The key issues raised were that, while the majority of students generally considered that they had at least a good understanding of scientific language used in their course and were competent in its use, they still felt that additional lectures or other resources should be provided. This would help students gain at least a minimum level of competence in the understanding of scientific language. Also, non-English-speaking students seemed less confident in their scientific understanding, although no significant correlation between perceived understanding and their test performance was found.

Therefore, in summary, the language quiz indicates that not having English as a first language may be a significant disadvantage. The results also indicate that a student whose first language is English improves with age and year of study, and that students whose first language is not English do not show the same improvement. In addition, those students who studied Latin, in addition to having English as a first language, obtained significantly higher test scores.

Table I. Summary of comparisons.

Comparison	Results n values in brackets	Test	Statistic	p	Conclusion
Median scores for first language	English 9 (174) other 4 (67)	Mann–Whitney	$W = 24193$	<0.001	Scores higher for first language English
Median scores for Male, Female	English: Male 8 (39) Female 9 (112)	Mann–Whitney	$W = 2602$	0.124	No gender difference
	Other: Male 2 (18) Female 5 (41)	Mann–Whitney	$W = 642$	0.193	No gender difference
Median scores for age groups (English)	21-25: **7** (54) 26-30: **9** (83) 31-40: **11.5** (20) >40: **12.0** (15)	Kruskal–Wallis	$H = 22.4$	<0.0001	Differences amongst age group scores for English 1st language
Median scores for age groups (other)	21-25: **3.5** (26) 26-30: **4.5** (32) 31-40: **2.0** (9)	Kruskal–Wallis	$H = 0.55$	0.76	No age group difference for Other 1st language
Median scores for year of study (English)	1st: **7** (54) 2nd: **9** (43) 3rd: **11** (34) 4th: **11** (19)	Kruskal–Wallis	$H = 24.6$	<0.001	Differences amongst year of study for English
Median scores for year of study (other)	1st: **3** (31) 2nd: **4** (14) 3rd: **6** (15) 4th: **3** (7)	Kruskal–Wallis	$H = 6.16$	0.104	No year of study differences for Other
Median scores for knowledge of Latin	Latin: **12** (26) No Latin: **9** (148)	Mann–Whitney	$W = 2926$	0.0059	Scores raised by study of Latin
Median scores for home language	English: **9.0** (147) English + European: **8.5** (10) English + Non-European: **6.0** (43) European: **4.0** (5) Non-European: **5.0** (27)	Kruskal–Wallis	$H = 24.8$	<0.001	Home language affects score
Median scores for parental language	English: **9.0** (156) European: **7.0** (16) Non-European: **5.0** (69)	Kruskal–Wallis	$H = 22.8$	<0.001	Parental language affects score

Table IIa. Effect of age (English first language).

	Age groupings			
	Age 21–25 7 (54)	Age 26–30 **9** (83)	Age 31–40 11.5 (20)	Age 40 + 12 (15)
Age 21–25		$W = 3123$ $p = 0.008$	$W = 1760$ $p = 0.001$	$W = 1618$ $p = 0.0001$
Age 26–30			$W = 4103$ $p = 0.076$	$W = 1004$ $p = 0.01$
Age 31–40				$W = 295$ $p = 0.422$

Post-hoc Mann–Whitney pair-wise comparisons following Kruskal–Wallis test results in Table I. Median values are shown in bold and p-values > 0.05 in italics.

Discussion

The design of the current questionnaire and language test aimed to assess initial feelings students perceived about their language abilities and their course of study. Generally, students perceived that they were at least competent in their use of written and oral language, although they did comment that a course of formal instruction may help to provide a platform which can help to minimise the differences in student ability. Whether the student support systems widely available (unlike, for example, that described by Austin & Dean, 2004) deal specifically with scientific language is not clear. However, the use of language terminology, particularly in the biomedical and related fields is specific and a deep understanding should not be taken for granted. Native speakers of Indo-European languages may be aware that the prefix *hydro-* is associated with water. However, it is every easy to forget that *hydro-* may be a meaningless term, or have a completely different meaning, to students whose first language is not Indo-European in origin. Such languages may have substantially different structures and grammars, and as this may impact upon learning and achievement it should be reflected in teaching, for example, in the manner adopted in Hungary and described by Antal et al. (2002).

The main component of the questionnaire was the language test. This, when contextualised against the demographic information provided, suggests that language has a significant impact upon learning and achievement in a degree programme where communication skills—both written and oral—are of substantial and ever-increasing importance. The words chosen for this study were selected according to their applicability to the pharmacy degree. It may be argued that an exposure to this terminology may bias the test as the students' progress through the course and gain more exposure to such terminology. However, while the average scores increase from Year 1 to 3, they plateau for Years 3 and 4 of the student population surveyed in this study. This may suggest that the results are not biased by the Royal Pharmaceutical Society of Great Britain's Indicative Syllabus as delivered at the University of Brighton. However, it also suggests that those who have not been exposed to this language may respond to the test differently compared to those who have possibly compensated for linguistic ability by recitation of course learning. The former group of students, for example first year undergraduates, would not have the scientific knowledge of their senior peers and may therefore respond to this test solely by their language abilities.

While it was the aim of this study to establish whether or not language was an issue in students' ability to understand scientific meta-language relevant to the MPharm, future studies should be able to decouple any overlap more precisely, and to establish how the current course structure deals with issues of language development as the course progresses. Another comment on this matter relates to the results reaching a plateau at Year 3. This, and the significant differences between Year 1 and Years 3 and 4 of the course might suggest that students' abilities in relation to their understanding of scientific language are, to some extent, equilibrated by exposure to the terminology of the degree programme by the end of Year 1 or Year 2 of the course, as results of these two years are not significantly different from each other. This must, however, be contextualised against the overall low scores achieved by students taking this test—a range of 5.3 to 9.4 out of 20.

Table IIb. Effect of year of study (English first language).

	Year of study			
	1st 7 (54)	2nd 9 (43)	3rd 11 (34)	4th 11 (19)
1st		$W = 2401$ $p = 0.076$	$W = 1897$ $p < 0.0001$	$W = 1751$ $p = 0.0018$
2nd			$W = 1376$ $p = 0.002$	$W = 1223$ $p = 0.045$
3rd				$W = 505$ $p = 0.89$

Post-hoc Mann–Whitney pair-wise comparisons following Kruskal–Wallis test results in Table I. Median values are shown in bold and p-values > 0.05 in italics.

Table IIc. Effect of Language(s) spoken at home.

	English 9 (147)	English + European 8.5 (10)	English + non-European 6 (43)	European 4 (5)	Non-European 5 (27)
English		$W = 788$ $p = 0.99$	$W = 3120$ $p = 0.002$	$W = 11467$ $p = 0.022$	$W = 13759$ $p = 0.0002$
English + European			$W = 357$ $p = 0.049$	$W = 22$ $p = 0.31$	$W = 267$ $p = 0.009$
English + non-European				$W = 1087$ $p = 0.26$	$W = 1599$ $p = 0.39$
European					$W = 66$ $p = 0.40$

Post-hoc Mann–Whitney pair-wise comparisons following Kruskal–Wallis test results in Table I. Median values are shown in bold and p-values >0.05 in italics.

Clear trends were observed between the demographic information provided by participants in the study and their test scores. It has been demonstrated that age and gender can influence primary and secondary language acquisition (Krashen et al., 1979; Schumann, 1975). No gender effect was shown in this study and the increase in ability with age was only shown for native English speakers. Of most importance is the impact that language background has on learning.

Almost all UK universities have excellent facilities which are designed to help students whose first language is not English. However, in almost all cases these resources are targeted at overseas students. It would appear that there is a gap in the provision of such services. This gap clearly focuses on students whose family backgrounds are either African or sub-continental Asian—areas where languages with a Greek or Latin foundation are not the first language, or many be infrequently spoken. General educational trends were clearly observed in this study, and they would suggest that the provision of specific language skills should not be targeted directly at overseas students. This mirrors the findings reported recently (Bhattacharyya, Ison, & Blair, 2003). They examined the achievements and participation of minority ethnic students in education and training. Clear trends were observed in overall educational attainment. While they may be attributed in part to socio-economic factors, other issues, including language, may influence attainment.

Table IId. Effect of parental first language.

	English 9 (156)	European 9 (8)	Non-European 5 (69)
English		$W = 12927$ $p = 0.66$	$W = 19746$ $p = <0.0001$
European			$W = 409$ $p = 0.103$

Post-hoc Mann–Whitney pair-wise comparisons following Kruskal–Wallis test results in Table I. Median values are shown in bold and p-values >0.05 in italics.

The influence of pre-school language ability has been shown to be higher for students from ethnic minority groups (Sammons, Sylva, Melhuish, Siraj-Blatchford, & Taggart, 2002). This was attributed to developing pre-reading and early number concepts in children. In such cases, children from non-European backgrounds scored significantly higher at language tests than white UK children. Such changes were not influenced by socio-economic factors or the parents' level of education. Therefore, while this study showed unclear trends in pre-school education, it may be a significant factor in improving later educational attainment in spoken and written English among ethnic groups where English is not commonly the first language.

One key aspect of current educational provision in the UK is the Widening Participation Agenda. The results found in this study would tend to support the extension of Higher Education opportunities to mature students, as test scores increased—and reached a plateau—with age. As well as providing educational opportunities to socio-economic groups who previously had limited exposure to Higher Education, the findings of this study would suggest that mature students have developed skills-sets necessary for the successful attainment of Higher Education goals, irrespective of their route into Higher Education. However, it is recognised that age may limit one's ability to successfully learn new languages (Schumann, 1975; Snow & Hoefnagel-Hohle, 1978; Collier, 1987)

From the linguistic point of view, the most difficult area—and the area where issues are more likely to arise—is in the use of anatomical or pharmacological terminology required to define a condition or course of treatment. A student's key requirement is comprehension of language within the context of their subject in the environment in which it is presented. Young (2005) commented that prior knowledge and the building of background knowledge facilitates student comprehension of scientific text, vocabulary and key concepts, and possibly *deep learning* (our italics). Students who understand the meta-language of their subject can communicate with competency in that

area, possibly reflecting a deeper level of understanding compared to a student who rote-learns this vocabulary. The main conclusion of this study is that students who do not have English as a first language have a poor grasp of this meta-language, which does not improve as their degree studies progress. The effect on their deeper understanding and insight into their subject remains unquantified, but may give cause for concern regarding their efficacy as health care professionals.

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