

Does a learning style preference for processing information through reflection impact on the academic performance of a cohort of undergraduate pharmacy students?

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Abstract

Background: Reflective processes have shown to improve clinical decision making skills. Furthermore, students tend to develop certain learning styles, some utilising reflective processes while others do not.

Aims: To investigate the relationships between reflective and non-reflective learning styles, and academic performance of pharmacy students.

Methods: Kolb's Learning Style Inventory (Kolb, 2007) and a demographic questionnaire were administered to first year undergraduates. Analysis was conducted using the statistical procedure, ANCOVA.

Results: 209 completed questionnaires (response rate 91%) indicated pharmacy students have a stronger preference for the assimilator (44%) learning style. Students who preferred to process information through reflection achieved greater academic success compared to those students who did not ($p < 0.05$). Gender was also a significant factor ($p < 0.05$).

Conclusion: This study presents evidence that suggests aspects of effective learning may involve reflection. Further research into the methods by which pharmacy students prefer to learn and their relationship with academic outcomes are recommended.

Keywords: Academic Performance, Higher Education, Kolb's Learning Style Inventory, Pharmacy Education, Reflection, Reflective Learning.

Introduction

Improving student learning and student engagement in learning tasks are pivotal in higher education, in addition to meeting curricula and learning outcomes such as academic achievement (Ramsden, 2003). Furthermore, fostering reflection amongst learners has the potential to improve academic performance (Mann *et al.*, 2009; Sobral, 2001; White *et al.*, 2009). In order for students to be academically successful, pharmacy educators need a greater understanding of the concepts related to student learning styles, reflective processes and academic performance.

Learning styles are considered a contributing factor of academic success (Romanelli *et al.*, 2009). Therefore, investigating learning styles and its impact on academic achievement can be beneficial for educators (Tsingos, 2013a). Reflective processes in learning also play an important role. Reflective learning involves processing information from different perspectives. A student who is considered a reflective learner, characteristically uses a "form of mental processing" (Moon, 1999, p.23) and makes connections with what they know now with previous knowledge or experience, thus allowing

judgments to be made by viewing situations from different angles (Dewey, 1933; Kolb, 1984; Schon, 1995; Tsingos *et al.*, 2014).

One way to understand reflective processes in learning is through the exploration of learning style models, such as the ways in which students process information and its relationship with academic performance measures (Tsingos *et al.*, 2015). A plethora of research has investigated the learning styles of students (Newble & Gordon, 1985; Chessell, 1986; Cavanagh *et al.*, 1995; Rakoczy & Money, 1995; Piane *et al.*, 1996; Shuck & Phillips, 1999; Felder & Brent, 2005; Hauer *et al.*, 2005; Mitchell & Nyland, 2005; Lujan & DiCarlo, 2006; Mountford *et al.*, 2006; Novak *et al.*, 2006; Suliman, 2006; Koch *et al.*, 2010; Zoghi *et al.*, 2010; Fleming *et al.*, 2011; Gurpinar *et al.*, 2011; Teevan *et al.*, 2011, Caulley *et al.*, 2012; D'Amore *et al.*, 2012; Williams *et al.*, 2012; El-Gilany & Abusaad, 2013; Loewen & Jelescu-Bodos, 2013; Milanese *et al.*, 2013; Samarakoon *et al.*, 2013; Williams *et al.*, 2013; Giuliano *et al.*, 2014) and its impact on academic achievement or performance outcomes (Markert, 1986; Joyce-Nagata, 1996; Davies *et*

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al., 1997; Severiens & Dam, 1997; Lynch et al., 1998; McManus et al., 1998; Linares, 1999; Dibartola et al., 2001; Diseth & Martinsen, 2003; Contessa et al., 2005; Demirbas & Demirkan, 2007; Dobson, 2009; Gurpinar et al., 2010; Komarraju et al., 2011; Prajapati et al., 2011; Alghasham, 2012; Wilkinson et al., 2014). However, there are only three studies investigating learning styles and academic outcomes amongst pharmacy students (Garvey et al., 1984; Sharif et al., 2010; Robles et al., 2012). One study was conducted over 30 years ago using an American cohort (Garvey et al., 1984), thus indicating a significant gap in the current published literature.

This study is the first Australian study to investigate the relationship between learning styles, reflective processes and academic performance in a pharmacy cohort.

(i) Theoretical Framework

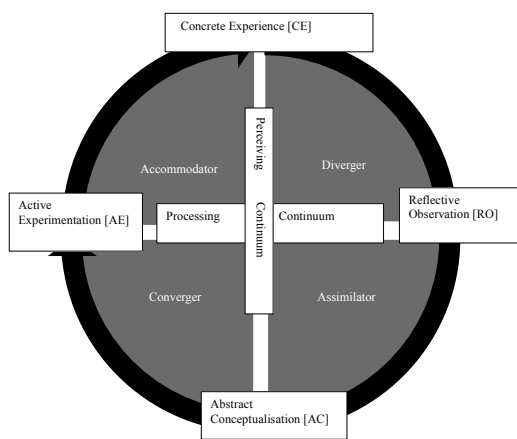
The theoretical framework for this study is derived from Kolb’s Experiential Learning Model (Kolb, 1984).

“Learning is the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience” (Kolb 1984, p.41).

Kolb’s model (Kolb, 1984) infers that experience forms the basis from which learning extends itself which is consistent with stages of human growth and cognition in terms of the learning process. He explains that experience, which forms the basis for *reflective observation*, is translated into concepts, which in turn serves as guides for decision making and drawing conclusions for future experiences (Kolb, 1981).

Four distinct learning styles have been derived from this cycle of experiential learning (Figure 1). Kolb’s model posits that four learning styles (assimilator, diverger, converger and accommodator) are made up of two dominant learning abilities, one from the perceiving continuum (either concrete experience (CE), or abstract conceptualisation (AC) and the other from the processing continuum (either reflective observation (RO), or active experimentation (AE) (Kolb, 1981; 1984) (Figure 1).

Figure 1: Kolb’s learning styles and Experiential Learning Model (adapted from Kolb, 1984)



For example, students who prefer to learn *via abstract conceptualisation and reflective observation* have a learning style characterised as an *assimilator*. Hence, assimilators perceive (grasp) information *via abstract conceptualisation* and process information *via reflective observation*. Conversely, accommodators perceive information *via concrete experience* and process information *via active experimentation* (Figure 1, Table I).

Table I: Characteristics of Kolb’s four Learning Styles

Learning Style	Dominant Learning Abilities	Characteristics of the learner
Assimilator	Abstract Conceptualisation & Reflective Observation	Serious, logical, structured learner, able to grasp high order concepts easily through abstract logic, are eager to follow up on independent reading from various academic sources, their greatest characteristic is in creating theoretical models through “inductive reasoning” (Kolb 1981, p.238) They value the expert knowledge of their mentors and experts in the field of their learning, practice reflective learning methods and behaviors, value didactic teaching approach.
Converger	Abstract Conceptualisation & Active Experimentation	Relatively unemotional learners who prefer to work independently rather than with people, to make small changes, like to experiment from their own ideas to actively solve problems through “hypothetical-deductive reasoning.” (Kolb 1981, p.238) They prefer technical tasks and working with practical applications such as interactive e learning and other technological media.
Diverger	Concrete Experience & Reflective Observation	Open-minded learners prefer to work in groups and learn by observation and reflection, imaginative, reflective observers who perform better in ‘brainstorming sessions’ (Kolb, 1981) and look at the big picture from different perspectives. They value constructive feedback and as team players, they prefer to work collaboratively to figure out problems.
Accommodator	Concrete Experience & Active Experimentation	Prefer to learn through ‘hands on’ approach and experimentation, often characterised as “risk takers” (Kolb 1981, p.238) using their ‘gut feel’ and intuition to actively solve problems. Prefer to work in teams to complete tasks, and learn primarily from their own practical experience rather than from traditional didactic measures. They benefit from learning through practical demonstrations and excel in situations where adaptation to situations is required.

Different characteristic traits underpin each learning style (Table I). For example, assimilators primarily learn through abstract theories and models and utilise reflection as a means to process their learning. Conversely, accommodators prefer to feel the experience, often through a ‘gut feel’ and actively solve problems through *active experimentation* (Table I). Therefore, as learning

styles have distinct characteristics, a greater understanding of students' preferred styles of learning would certainly be beneficial for pharmacy educators. Moreover, research has shown that university student learning styles influence academic success and learning outcomes (Lynch *et al.*, 1998).

(ii) Use in other Health Professions

Kolb's learning style construct has been utilised by many health professions including medicine (Davies *et al.*, 1997; Airey *et al.*, 2001; Gurpinar *et al.*, 2011; Caulley *et al.*, 2012), nursing (Cavanagh *et al.*, 1995; Rakoczy & Money, 1995; Linares, 1999; Hauer *et al.*, 2005; Suliman, 2006; Zoghi *et al.*, 2010; Molsbee, 2011; D'Amore *et al.*, 2012; El-Gilany & Abusaad, 2013) and allied health (Piane *et al.*, 1996; Linares, 1999; Williams *et al.*, 2012) such as, physiotherapy (Mountford *et al.*, 2006; Zoghi *et al.*, 2010), occupational therapy (Hauer *et al.*, 2005) and radiography (Fowler, 2002; Zoghi *et al.*, 2010). Few studies investigating learning style models of pharmacy students or pharmacists exist in the published literature (Garvey *et al.*, 1984; Shuck & Phillips, 1999; Austin, 2004a; Austin 2004b; Novak *et al.*, 2006; Sharif *et al.*, 2010; Teevan *et al.*, 2011; Crawford *et al.*, 2012; Robles *et al.*, 2012; Eng, 2013; Loewen & Jelescu-Bodos, 2013; Williams *et al.*, 2013; Giuliano *et al.*, 2014) with even fewer studies investigating learning styles of pharmacy students using Kolb's model, despite the wide use of this instrument in other health profession education fields (Garvey *et al.*, 1984; Robles *et al.*, 2012; Eng, 2013; Williams *et al.*, 2013).

It could be argued that with the dearth of research of learning styles in the pharmacy education settings, an understanding of today's pharmacy students' learning styles has important implications for pharmacy education. Gaining an understanding of the pharmacy students' learning styles, teaching methods can be refined and tailored to improve student experience and enhance learning outcomes such as academic performance.

(iii) Learning Styles and Reflection

Many learning style constructs conceptualise reflection as a form of information processing or learning. Kolb's Model includes *reflective observation* as preference for information processing. Reflective observation refers to the way in which learners reflect on a critical incident, event or situation, observing the environment before making any judgements and viewing a situation from different perspectives (Kolb, 1984). *Reflective observation* is considered a technique of reflective learning. Reflective learning is a process whereby students utilise new knowledge and link it with prior knowledge and experience to come to new insights and understandings (Tsingos *et al.*, 2014; 2015). Ultimately, these new perspectives will bring about a change in behaviour which will assist with future actions or practice (Tsingos, 2013b; 2014).

Reflective learning has the potential to improve academic performance (Sobral, 2001; White *et al.*, 2009; Tsingos *et al.*, 2015) develop deep, lifelong learning (Plack & Greenberg, 2005; Tsingos *et al.*, 2014; 2015), and to enhance integration of theory with clinical practice (Mann *et al.*, 2009; Tsingos *et al.*, 2014). Thus, research into this concept is essential for the pharmacy field.

(iv) Learning Styles & Academic Performance

There is a concomitant gap in the literature assessing the relationship between learning styles and academic performance in pharmacy education. Other health professions have investigated learning styles in relation to academic performance outcomes (Contessa *et al.*, 2005, Davies *et al.*, 1997, Dibartola *et al.*, 2001, Dobson, 2009, Gurpinar *et al.*, 2010, Linares, 1999, Lynch *et al.*, 1998, Markert, 1986, Piane *et al.*, 1996, Prajapati *et al.*, 2011). However, research in other areas cannot be generalized to the pharmacy field. Published literature of learning styles and its relationship with academic performance of pharmacy students is scant. In fact there is no current research investigating the relationship between learning styles and academic performance in an Australian population of pharmacy students and only three studies worldwide investigating the relationship between academic performance with learning style in non-Australian cohorts (Garvey *et al.*, 1984, Robles *et al.*, 2012, Sharif *et al.*, 2010). Here lies a significant gap in the literature.

This study investigates the relationships between learning styles, reflective processes and academic performance of first year undergraduate pharmacy students.

Methods

Approval from the University of Sydney Human and Ethics Committee was obtained prior to the commencement of the study. This project commenced in the second semester (August 2013 - November 2013). An overview of the study was verbally explained and via a power point presentation to the student cohort. A written explanatory statement in the form of a Participant Information Statement (PIS) was distributed to all participants. Participation was voluntary and participants had the right to withdraw from the study at any stage.

All students (n=249) who were enrolled in the first year undergraduate pharmacy unit of study (PHAR1821) at the University of Sydney were invited to volunteer for the study. Study participants were aged 18 years and over and included both males (n= 77) and females (n=132).

(i) Social Pharmacy Context

This course is a second semester course which builds on the first semester's Foundations of Pharmacy Course (UoS PHAR1811). The Social Pharmacy Course explores the psychological and social aspects of patient health care, teamwork and its role in the overall health care system. Topics include: (i) models of healthcare, (ii) patient self-management, (iii) chronic diseases, (iv) rural

health issues. The emphasis is on the psychological aspects that underpin patient behaviour. Students have three lectures per week and a compulsory attendance to a two hour weekly tutorial. Other activities include: small group work and involvement in role plays. Assessment tasks include: (i) an oral presentation, (ii) an essay and (iii) an end of semester written examination.

(ii) Procedure

The Kolb's Learning Style Inventory 3.1 (KLSI-3.1) (Kolb, 2007), a 12-item learning style questionnaire along with a four-item socio-demographic questionnaire was distributed to all participants (n=249) enrolled in the UoS PHAR1821. Socio-demographic questions related to gender, age, and previous degrees were collected (Appendix A). Both the distribution and administration of the KLSI and demographic questionnaire took place on the premises of the Faculty of Pharmacy, during an allocated tutorial time. Participants were allowed approximately 25 minutes to complete the questionnaires.

(iii) The Instrument

Kolb's Learning Style Inventory, KLSI (Kolb, 2007), a 12-item self-report instrument was used to measure the preferred learning style. The reliability of this instrument and previous versions of the instrument has been supported and validated by a number of worldwide studies. Prior research has shown Cronbach alpha scores in acceptable ranges (Kayes, 2005; Loo, 1996; Willcoxson & Prosser, 1996), high test-retest reliability with the revised version of KLSI (Veres *et al.*, 1991) and support of KLSI as a pedagogical tool (Loo, 1999). In addition, prior research supports internal reliability of the Learning Style Inventory 3.1 scales of concrete experience, reflective observation, abstract conceptualisation and active experimentation (Kayes, 2005).

To complete the Inventory, participants are asked to rank phrase endings related to their learning preferences. The rank value of each response is placed into one of four categories of learning abilities (CE, RO, AC, AE, Figure 1). The four learning styles are then derived by plotting values of the differences between the opposing learning abilities (AC-CE) and (AE-RO) on perpendicular axes. Once plotted on the Learning Style Grid, each style (assimilator, diverger, converger, accommodator) is represented as a quadrant derived from the cycle of learning (Figure 1).

(iv) Academic Performance

Academic performance was measured from the overall marks achieved in the unit of study of *Social Pharmacy* (UoS: PHAR1821). The overall mark was derived by combining the marks from the final examination along with group work assessments.

(v) Analysis

Descriptive statistics and ANCOVA statistical procedures were conducted. Based on student scores on KSLI, students were coded into one of two groups, Reflective Observers (assimilators and divergers) and Non-Reflective Observers/Active Experimenters (convergers and accommodators). The statistical procedure, ANCOVA (analysis of covariance) was conducted to determine if there were any differences between the two groups of students, whilst controlling for other factors: gender, age and previous degrees. ANCOVA provides a means for eliminating any bias between the groups as well as reducing any within-groups error in the analysis (Coakes, 2013). Results were collated and analysed via the Statistical Package for Social Science (SPSS), version 20 (IBM Corp, Released 2011). The significance level was set at $p < 0.05$ level.

Results

A total of two hundred and twenty seven questionnaires were returned (response rate of 91%). Eight percent of the returned questionnaires were invalid as these were not correctly filled, leaving a robust sample size of two hundred and nine participants.

The preferred learning styles adopted by first year pharmacy undergraduate students (n=209) show a dominant 44% classified as assimilators, followed by 25% classified as convergers. (Table II). Proportionally, 64% of the cohort preferred to utilise reflective observation to process information rather via active experimentation (36%) (Table II).

Table II. Distribution of learning styles in a pharmacy undergraduate cohort at an Australian University

Learning Style Category	Preference method to perceive (grasp) information	Preference method to process information	Frequency	%
Assimilator	Abstract Conceptualization	Reflective Observation	92	44.0
Diverger	Concrete Experience	Reflective Observation	41	19.6
Converger	Abstract Conceptualization	Active Experimentation (Non-Reflective)	53	25.4
Accommodator	Concrete Experience	Active Experimentation (Non-Reflective)	23	11.0
Total			209	100.0

ANCOVA showed a statistically significant difference between those students who preferred to process their information via reflective observation rather than active experimentation (non-reflective process) and overall

academic performance (Reflective Observers mean 64.07, Non-Reflective Observers mean 61.46, $F(1, 201) = 5.677$, $p = 0.018$). Significant differences in gender were also evident. Females scoring higher marks compared to males (females mean score 64.78, males mean score 59.94, $F(1,206) = 19.22$, $p < 0.001$). There was no statistically significant effect of age group (whether they were of mature age or not), or previous education in relation to their outcome in overall academic performance (Table III).

Table III: ANCOVA: Analysis of Covariance of between subjects effects using the dependent variable: Overall Marks for the UoS

Dependent Variable: Overall marks for the UoS					
Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1515.516 ^a	4	378.879	6.658	<0.0005
Intercept	3994.855	1	3994.855	70.199	<0.0005
Gender	1084.747	1	1084.747	19.062	<0.0005
Previous degree	38.994	1	38.994	.685	0.409
Age	14.423	1	14.423	.253	0.615
Reflective Group Classification	323.039	1	323.039	5.677	0.018
Error	11438.450	201	56.908		
Total	833721.000	206			
Corrected Total	12953.966	205			

^a - R squared = 0.117

Discussion

This study aimed to identify the learning style preferences for information processing of first year pharmacy undergraduates at an Australian university and their relationship with academic performance. The findings showed there are significant differences between students who preferred to utilise *reflective observation* as a means to process information compared to those students who did not. Students who utilised the process of *reflective observation* achieved higher academic results compared to those who did not. In addition to reflective processes contributing to greater academic success, gender was also found to be a significant factor with females outperforming males. Gender differences in learning are consistent with previous research (Severiens & Dam, 1997), however further studies unpacking the gender differences of reflective and non-reflective learning styles are recommended.

Research in other health disciplines has shown that learning styles influence academic performance (Nagata, 1996; Piane *et al.*, 1996; Davies *et al.*, 1997; Joyce-Lynch *et al.*, 1998; Dibartola *et al.*, 2001; Contessa *et al.*, 2005;

Gurpinar *et al.*, 2010; Koch *et al.*, 2010), however exploration of the relationships between pharmacy student's learning styles and academic performance in the published literature is scant. Furthermore, this study is the first Australian study to look at academic performance in relationship with learning styles in a pharmacy cohort.

This study reported a greater preference amongst the pharmacy students for the assimilator learning style. Assimilators perceive information in an abstract manner and process information through *reflective observation*. Characteristically, assimilators prefer private study and self-directed learning strategies. They benefit from lecture and didactic teaching and prefer learning in this manner compared to the other three learning styles (Table 1). Interestingly, the higher education sector has seen recent moves away from didactic teaching methods, which may present a challenge particularly for these students (Ramsden, 2003). Perhaps the reason for the majority of first year students who adopt this preferred learning style is because students have come from the formal secondary education years, learning with a primarily didactic approach. This preferred approach to learning may have been instilled in them by the time they had reached their first year at university or college. Unfortunately, the approach to learning encouraged during the formal secondary education years, involves learning material to meet prescribed learning outcomes. There is less emphasis on the construction of knowledge and reflective thinking processes. This research provides some evidence to support reflective processes in learning.

The limitations of the study include: (i) The sample comprised first year undergraduate pharmacy students only and (ii) academic performance was limited to one unit of study.

Research has shown that utilising a learning style tool for curriculum development in health education will enhance reflective practice by promoting student-centred learning (Williams *et al.*, 2012). As this study presents evidence to suggest that reflection may be positively associated with academic success, further research unpacking this component and its influence on academic performance measures are recommended. Furthermore, research in terms of longitudinal studies would be beneficial, particularly as pharmacy students progress from a theoretical to a clinical setting.

Pharmacy students are not a homogenous group of students when it comes to learning. Therefore, for pharmacy educators, understanding the predominant learning styles of their students deserves greater consideration. Through understanding of predominant learning styles, refining and tailoring approaches to teaching can enhance both student engagement in a learning task and subsequently foster greater academic success.

Integrating reflective learning modules into pharmacy curricula has the potential to enhance reflective ability amongst pharmacy students, as reflection is a skill that can be taught and developed to improve academic performance (Mann *et al.*, 2009; Bernard *et al.*, 2012;

Tsingos *et al.*, 2014). This is particularly important when the learning environment changes from a theoretical to a practical setting in pharmacy education, where bridging the 'theory-practice gap' can be particularly challenging for educators. Facilitating students to adopt reflective learning approaches may have a greater impact on academic achievement and produce a pharmacy student with enhanced skills of clinical competency to adapt to different learning and clinical situations.

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Appendix A: Demographic questionnaire administered to first year undergraduate pharmacy students

The University of Sydney		
Faculty of Pharmacy		
Investigating the preferred learning styles in first year undergraduate pharmacy students and its impact on academic performance at the University of Sydney		
1. Gender (circle option)	Male	Female
2. Age: (circle option)	16 – 25 years	25 years plus
3. Your SID number is:	
4. Any previous degrees?	Yes	No
If so, what degree?	