# Assumptions about Knowledge and Learning Approaches Amongst South African Postgraduate Students

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**ABSTRACT** A common thread in contemporary research in student learning refers to the ways in which students go about learning. Research evidence implies that for meta-cognition (meta-learning) to take place, students should be aware of their own learning processes and have control over them. The concept of meta-learning leads to a model of student learning in which the respective links between knowledge assumptions, personal factors, the situational context, approaches to learning and the quality of outcomes are all mediated by the students' meta-learning capabilities. The purpose of this current study, based on a quantitative empirical study amongst a group of postgraduate students at the University of South Africa, was to examine the link between two of these constructs, namely the 'knowledge assumptions' and 'learning approaches' among them. Research done so far has mainly focused on 'approaches to learning' and has very seldom integrated this construct with others, such as students' epistemological beliefs about learning and knowing. An epistemological questionnaire and a learning process questionnaire accompanied by a five-point Likert scale were used as research instruments and distributed during a discussion class of 125 postgraduate students to assess this relation. An exploratory and a confirmatory factorial analysis were used to analyse the data. The findings confirm a positive relationship between knowledge assumptions and learning approaches amongst participants and suggest that universities should provide the necessary support to foster the development of a mature learning experience amongst their students. The study provided substantial justification for looking at epistemological beliefs in the study of learning approaches among university students.

## INTRODUCTION

The study of student learning on postgraduate level has developed as a research area in its own right only in the last 10 to 15 years. Earlier work was restricted essentially to the prediction of academic performance by such factors as Intelligence Coefficient, socio-economic status, personality, cognitive style variables, special abilities, prior knowledge and interest in subject matter. 'Academic performance' was conceived of in ways little different from any other kind of performance; a student was simply characterised as the intersection of several cognitive and affective variables. That view has since been modified considerably, in particular by the recognition that the learning undertaken by students has its own context and parameters that may not be shared with other performances (Meyer 2000; Biggs 2001; Richardson 2005; Botha 2013).

This new approach derives from the work of several authors (Entwistle et al. 1991; Biggs 2001; Cano and Cardelle-Elawar 2004; Dogan and Atmaca 2012), all of whom see student learning as a field in its own right, with its own problems, concepts and methodologies. A common thread in these studies refers to qualitatively distinct ways in which students go about learning. The major source of disagreement concerns the role of knowledge assumptions as well as personality and situational factors in determining observed approaches to learning.

One body of researchers (Biggs 2001; Richardson 2005) emphasised the situation-specific determinants of learning. Students learn in the way they do because they construe their present situation in a way that determines their approach to the task, namely learning in order to meet set requirements with minimal effort. Other researchers (Rodriques and Cano 2006; Dogan and Atmaca 2012) tend to emphasise that learners react in a way typical for them across situations, as well as in a way dictated by a particular situation.

Research done so far on examining students' learning experience (Entwistle et al. 1991; Meyer 2000; Biggs 2001; Cano 2005; Richardson 2005) has mainly focused on aspects such as 'approaches to learning' and has very seldom integrated the construct with others such as 'students' beliefs about learning and knowing'. According to Cano and Cardelle-Elawar (2004), this lack of attention in integrating learning approach-

es with knowledge beliefs is surprising given that the origin of these constructs can be traced back to the pioneering work of Perry (1970) in this field (Schommer 1993, 1994). The central tenet and hypothesis of this present study is that the two constructs (epistemological beliefs and learning approaches) among students are indeed related among postgraduate university students.

## Problem Statement and Purpose of the Study

With this hypothesis in mind, the problem statement for the study can now be phrased as follows: What is the link or relation between knowledge assumptions (epistemological beliefs) and learning approaches among postgraduate university students? The main aim and purpose of the study was therefore to provide an in-depth analysis of the link between epistemological beliefs and learning approaches among postgraduate university students. Before addressing the research problem, the constructs of epistemological beliefs (EBs) and learning approaches (LAs) will be first be conceptualised.

## Theoretical Foundations of the Study

### Conceptualising the Construct of 'Knowledge Assumptions'

To clarify the aim of this study, a brief discussion and summary of the construct of 'assumption of knowledge' follows. According to Richardson (1994), the study of the assumption of knowledge is known as the 'epistemology', which means 'the theory or science of knowledge', and it is mainly concerned with the nature, scope and limitations of knowledge. This science considers topics such as the nature of knowledge and how it is acquired. In simpler terms, the science of knowledge explains 'how we know what we know'. Much of the debate in this field has focused on analysing the nature of knowledge and how it relates to connected notions such as truth, belief and justification in human (Brownlee et al. 2001; Botha 2013).

According to the epistemology or theory or science of knowledge, peoples' assumptions of knowledge can be conceptualised according to Schommer's 1990s taxonomy. At that time, Schommer (1990, 1994) challenged Perry's theoretical stance, submitting that beliefs are too

complex to be captured in a single dimension, and proposed a multidimensional construct which she called 'epistemological beliefs' (EBs). Schommer (1990) sees EBs as a system of more or less independent beliefs. By 'system', Schommer (1993) means that there is more than one belief to consider, and by more or less independent, she means that a person may hold some sophisticated beliefs about knowledge but may also have some less sophisticated views. With this in mind, Schommer (1993) identified the following four EBs as the most important independent beliefs about human knowledge:

- *A Belief in Simple Knowledge:* Some people believe that knowledge is best characterised as isolated facts, which they perceive as separate and unrelated.
- *A Belief in Absolute Knowledge:* Some people believe that knowledge is absolute, which means that they perceive knowledge as a certainty and argue that there is no error in scientific discoveries.
- *A Belief in Innate Knowledge:* Some people hold that learning ability is fixed and that human ability is not the product of achievement and not subject to improvement.
- *A Belief in Quick Learning:* This view holds that learning is not a gradual process, but when it happens, it happens quickly and instantly.

In the late 1980s, Schommer (1990) and others argued for an alternative approach to conceptualising people's EBs. She argued that epistemologies can be separated into a number of independent beliefs and consequently proposed three further beliefs, namely a belief in how 'complex knowledge' is (ranging from complex to simple), a belief in how 'certain knowledge' is (ranging from highly certain to highly uncertain) and a belief in the 'source of knowledge' (for example, knowledge coming from authority). According to Schommer (1990), these beliefs are more or less independent from one another. For instance, a person may believe in complex but certain knowledge, complex but uncertain knowledge, simple and certain knowledge or simple but uncertain knowledge.

Schommer (1990) went on to propose an influential way to measure EBs. In contrast to developmental work, which had relied principally on interviews and, to a lesser extent, on written, open-ended questions, she developed a questionnaire, widely referred to as the Epistemolog-

ical Questionnaire (EQ), which is still regularly used today in studies on EBs. Other researchers in this field have since developed analogous scales tapping overlapping but not identical sets of EBs. Hofer (2000) has, for example, developed a questionnaire with items that also addressed four similar beliefs.

Hofer's questionnaire (Hofer 2000) was designed so that the questions also referred to a specific field. In other words, in contrast to the questions developed by Schommer (1990), his questions did not refer to knowledge in general but to knowledge in a specific field such as science or mathematics. The first two epistemological beliefs in Hofer's questionnaire, namely 'certainty' and 'simplicity', were about the nature of knowledge, while the third and fourth beliefs addressed the issue of how a person comes to 'know' or 'learn' something, namely the 'source of and justification for knowledge'.

Beyond identifying these four dimensions in personal epistemology, Schommer (1990) also demonstrated "how these beliefs may influence comprehension and cognition of academic tasks, and her work has been the most concerned with classroom learning" (Hofer and Pintrich 1997: 90). Several studies have examined the influence of EBs on academic performance, and results indicate that the former predict the latter. The less students believed in quick learning, fixed ability, simple knowledge and certain knowledge, the higher their academic performance (Schommer 1993; Schommer et al. 1997; Cano 2005; Botha 2013). However, this link between EBs and academic performance among postgraduate students does not farm part of this current study, but will be the focus of a future empirical study.

In conclusion, while much has been theorised, researched and reported about epistemological beliefs over the past few decades, the author has selected and summarised a few additional and relevant conclusions about EBs that have been drawn by different researchers, namely:

- There is a 'common sense theory of knowledge present in the average person' that develops as the person grows from child to adulthood (Kitchener 2002).
- Some EBs developed earlier than others. For example, EBs about institutional (socially or humanly constructed) facts developed earlier than those about brute (physical, or

scientifically tested and proven) facts (Hallett et al. 2002).
- EBs is context specific (Kitchener 2002).
- It appears that a tertiary education has a major influence on the development of more sophisticated EBs (Kitchener 2002).
- Core beliefs about knowing influence other beliefs, knowledge, and behaviour (Brownlee et al. 2001).

Since Schommer's 1990 questionnaire is, as already mentioned, still widely used today in various empirical research studies on EBs, it was decided to use this questionnaire to assess the participants' EBs. Having conceptualised the assumptions about knowledge in terms of the work of different scholars in the field, the concept of students' learning approaches will now be dealt with.

## *Conceptualising the Construct of 'Learning Approaches'*

According to Biggs (2001), learning approaches (LAs) are strongly related to students' ideas or conceptions of learning, and refer to how students learn in terms of their learning intentions (motives) and their learning methods (strategies). This construct plays a central role as a process between the input (teaching context, student factors) and the output (quality of cognitive learning outcomes) (Säljö 1982).

In his work on LAs among students, Biggs (1987a) identified inter alia two contrasting and theoretically opposed approaches among students, namely a 'deep' approach and a 'surface' approach. Other authors, such as Cano (2005), referred to indeed three predominant LAs among students, specifically in the higher education field, namely a 'deep' approach (based upon understanding the meaning of course materials), a 'surface' approach (based upon memorising the course materials for the purposes of assessment) and am 'achieving' approach (based upon obtaining the highest grade). According to Cano (2005), the 'deep' and 'surface' approaches to learning differ from the 'achieving' approach in an important way.

The strategies involved in the first two approaches describe ways in which students engage the context of the task itself, while the 'achieving' strategy describes the ways in which students organise the temporal and spatial contexts surrounding the task. There is, then, no inconsistency in rote learning in a highly organ-

ised way ('surface- achieving') or reading for meaning in an organised way ('deep-achieving'). It is, however, difficult to see how one could simultaneously rote learn and seek meaning, which is not to say that these strategies may not be deployed successively (as they are for instance by actors when learning, then interpreting, their lines) (Richardson 2005; Rodriques and Cano 2006; Dogan and Atmaca 2012).

According to Biggs (1987b), it would be generally agreed that a student who adopts a 'deep' approach are interested in the academic task; derives enjoyment from carrying it out; searches for the meaning inherent in the task; personalises the task; making it meaningful to own experience and to the real world; integrates aspects or parts of the task into a whole; sees relationships between this whole and previous knowledge and tries to theorise about the task by forming hypotheses. These students' approaches to learning tend to conceive learning as a transformation of information. They also tend to be intrinsically motivated and to use strategies focusing on the meaning of the material to be learned. A student who adopts a surface approach, on the other hand, sees the task as a demand to be met; a necessary imposition if some other goal is to be reached (a qualification for instance); sees the aspects or parts of the task as discrete and unrelated either to each other or to other tasks; is worried about the time the task is taking; avoids personal or other meanings the task may have; relies on memorization and attempting to reproduce the surface aspects of the task. These students' approaches to learning are more tending to conceive learning as mere a reproduction of knowledge. They tend to be extrinsically motivated and to use strategies focusing on the reproduction of those materials. This implies a context-specific approach to learning (Entwistle et al. 1991; Botha 2013).

Over the years various questionnaires or inventories have been developed to gain insights into what students usually do while learning (Biggs 1987b; Marton et al. 1997; Watkins 2001) and, in the process, assess students' readiness to adopt either the 'deep' or 'surface' approaches to learning in general. One of the more recent LAs questionnaires, developed by Biggs (1987b), was called the Study Process Questionnaire (SPQ). It was followed by his improved version (1991), referred to as the Learning Process Questionnaire (LPQ). Biggs (2001) preferred

the term 'approach' to refer to the manner in which students go about their learning tasks, as assessed by means of questionnaires such as the SPQ and the LPQ. There is, then, considerable theoretical and empirical support for summarising the affective and cognitive components present in the study process complex in terms of at least two independent approaches to learning, namely 'deep' and 'surface'.

An important aspect of LAs is their relationship with meta-cognition or meta-learning, defined by Baird (2004: 34) as "the knowledge, awareness and control of one's own learning", as related constructs. A common thread in contemporary research in student learning refers to the ways in which students go about learning. A theory of learning is commonly presented that accentuates the interaction between the person and the situation. Research evidence implies that for meta-cognition to take place, students should be aware of their own learning processes and have control over them. The concept of meta-learning leads to a model of student learning in which the respective links between personal factors, the situational context, the various approaches to learning and the quality of outcome are all mediated by the students' meta-learning capabilities.

When students learn, they play an active role in determining what they will learn (intention) and how they will learn it (strategy). In addition, it is well documented (Watkins 2001; Lizzio et al. 2002; Baird 2004) that students' LAs are related to a number of factors, some of which are categorised as personal factors (for example a student's perceived self-ability, prior knowledge) and others as contextual factors (for example the teaching- learning activities, climate). In general terms, 'deep' LAs are likely to be supported by an interest in and background knowledge of the material to be learned, a well-planned and well-resourced learning environment, an appropriate workload and a warm classroom climate (Watkins 2001; Lizzio et al. 2002). Since LAs are meaningful in the context of the teaching–learning system, they "provide the barometer readings that tell how the general system is working" (Biggs 2001: 99).

An important topic of debate amongst researchers is whether students' LAs change as a result of their formal educational experiences as they progress in their studies. Much research has been undertaken on this issue, but the evi-

dence is inconclusive. While some studies found a decline in the students' scores related to a 'deep' approach to learning (Biggs 1987b; Gow and Kember 1990; Biggs and Moore 1993; Biggs and Watkins 1995), others found indeed the opposite (Watkins and Hattie 1981; Richardson 1994; Davis and Sales 1996). Generally, authors comment that university students probably tend to use less desirable approaches ('surface') as they are adapting to the new institutional demands (for example a too full curriculum, work pressures, assessment procedures) (Gow and Kember 1990; Kember 2000). When these demands alleviate, students' LAs seem to shift towards meaning and conceptual 'deep' understanding.

Since Biggs' improved version of the learning process questionnaire (LPQ) of 1987 is still widely used today in studies on LAs, it was decided to use the LPQ as instrument for this study to assess the participants' LAs. Having now conceptualised the constructs of 'epistemological beliefs' and `learning approaches' among students, the link or relationship between the two constructs, which is the central focus of the study, will now be discussed.

### The Relationship between Epistemological Beliefs and Learning Approaches

Although EBs and LAs are to some degree connected with Perry's works of 1970 (Perry 1970), very little is known about their interrelationships. In 1981, Perry speculated about the links between EBs and ways of studying, but did not explore them. Some studies (Davies 1997) have indicated a relationship between 'conceptions of knowledge' and 'conceptions of learning'. Davis (1997) found that while students' absolutist views of knowledge corresponded to reproductive learning conceptions, students' relativistic knowledge conceptions were associated with meaning-orientated learning conceptions.

More recently, Cano and Cardelle-Elawar (2004) demonstrated that students' EBs were significantly associated with their conceptions of learning: the higher students' scores on complex and sophisticated beliefs ('deep' approach to learning), the more elaborate and meaning-orientated their conceptions of learning. This entails that if EBs is linked to learning conceptions and the latter is associated with LAs (Säljö

1982), it would seem that EBs and LAs must also be linked (Case and Gunstone 2002; Botha 2013).

Two recent studies by Chan (2003) and Cano (2005), did find some empirical evidence of a positive link between EBs and LAs. According to Chan (2003), correlation analysis revealed that the 'deep' approach to learning was negatively associated with authority/expert knowledge, and positively related to learning effort/process, and that the 'surface' approach was positively correlated with certain knowledge and authority/expert knowledge. Cano (2005), in turn, administered the Learning Process Questionnaire (LPQ) and the Epistemological Questionnaire (EQ), referred to earlier in the study, to a number of students and examined its dimensionality by carrying out exploratory and confirmatory factor analyses. Two factors emerged for the LPQ (namely the 'deep' and 'surface' approaches) and three factors for the EQ (namely 'quick learning'; 'simple knowledge' and 'certain knowledge'). These factors have formed the basis of this study.

The question remains whether there is also empirical evidence of a link between EBs and LAs is among a number of postgraduate students from the University of South Africa?

### RESEARCH METHODOLOGY

In this section the details of the sampling, administration and instrumentation are outlined. The study sample, based on earlier and similar studies by Rodriguez and Cano (2006) and Botha (2013), consists of a total of 125 post graduate students from the University of South Africa, 32% of whom were male, and 68% were female. Participants, ranging in age from 27 to 56, were made up of those attending discussion classes when the questionnaires were administered during class sessions. All the students agreed to participate voluntarily. They were each given a pack containing information about the research, questionnaires and instructions, as well as assurances regarding the confidentiality of all data collected. They were asked to answer both questionnaires, giving their full name, age and sex, and indicating their agreement by signing a consent form. All participants were enrolled for the BEd-module in Education Management and were either in the first or the second year of studies. Being one of the lecturers for this course, it enables the researcher to obtain a rich and unbiased data source for subsequent analyses. It

was neither required to sample on a random basis, nor to obtain a range of other data. Nevertheless, comparisons with other samples such as that of Rodriguez and Cano (2006) indicated that the present data were satisfactory.

Two research instruments were used for the study and consist of Schommer's (1993) Epistemological Questionnaire (EQ) and Biggs's (1991) Learning Process Questionnaire (LPQ). Evidence on the test-retest reliability and on the consistency of the scales and subscales of the LPQ and the SPQ was provided. Reliability estimates were obtained both from the present sample and were judged to be satisfactory.

The curriculum for this course can be described as a combination of theory and practical applications. The design of the module and its outcomes are explicitly based on defined levels of understanding (constructive alignment) (Biggs 2001), and planning a coherent teaching–learning environment which allows students to construct active knowledge related to real-life school situations (Entwistle et al. 1991). Assessment includes interactive sessions (group discussion classes) and essay writing that focus on conceptual understanding.

The EQ comprised 10 groups of items consisting of statements about learning and knowledge that students rated on a Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). To ensure the applicability of this questionnaire study sample, two types of factor analyses were carried out, namely exploratory and confirmatory. The exploratory factor analysis revealed the presence of Schommer's (1993, 1998) four factors, namely:

- *Factor 1:* Belief in quick learning or not at all.
- *Factor 2:* Belief in simple knowledge (knowledge is handed down by authority).
- *Factor 3:* Belief that the ability to learn is fixed and unchangeable).
- *Factor 4:* Belief in certain knowledge.

Inter-item reliabilities for items composing each factor, measured by means of Cronbach's Alpha coefficient were 0.62; 0.54; 0.60 and 0.55 respectively for factors one to four. The structure largely resembles the factors obtained by Schommer (1993, 1998). It is important to point out that the higher a student's scores on these factors, the more naive his/her EBs. So, for example, a student who obtains a high score on fixed ability will believe, in a naive way, that the

ability to learn cannot be improved. A confirmatory factor analysis was also carried out, which provided a reasonably acceptable root mean square residual (RMR) of 0.05.

The LPQ (for assessing students' LAs) was composed of an interference model, consisting of six sub-scales with five items in each. The students also rated these on a five-point Likert-type scale from 1 (never or rarely true of me) to 5 (always or almost always true of me). The six sub-scales measured the learning approach dimensions proposed by Biggs (1993), namely 'surface motive', 'surface strategy'; 'deep motive', 'deep strategy'; 'achieving motive' and 'achieving strategy'. The six sub-scales were also subjected to two types of factorial analyses, exploratory and confirmatory. Exploratory factor analysis indicated the presence of two factors, namely the `deep motive' and `deep strategy' sub-scales loaded on Factor I ('Deep') and the `surface motive' and `surface strategy' sub-scales loaded on Factor II (`Surface'). Reliability, measured by means of Cronbach's Alpha coefficient, was 0.62 for Factor I and 0.43 for Factor II. The two-factor structure is in line with the results submitted by other authors (Kember and Leung 1998) and satisfies the definition of an interference model mentioned above: two distinct but contrasting dimensions of variation in students' learning.

## OBSERVATIONS AND DISCUSSION

The exploratory factor analyses of the EQ and LPQ mentioned above were taken as starting point to obtain a measure of the two main constructs of this study. EBs and LAs were measured by means of factor scores (obtained by multiplying the standard scores for the original variables by the factor score coefficients). This relationship was examined using a canonical (approved or acceptable) correlation analysis which measures the relationship between two sets of variables, with one set of variables consisted of EBs and the other of LAs. The first canonical correlation was 0.53 (24% of variance) and the second was 0.34 (12% of variance).

Therefore, the two pairs of canonical variables accounted for the significant relationships between the two sets of variables, and were saved for later use (F1 is the name assigned to the first canonical variable in the first set, and F2 to the second; S1 is the name assigned to the

first canonical variable in the second set, and S2 to the second). Data on these two pairs of canonical variables appears in Table 1.

The total percentage of variance and total redundancy indicate that the first pair of canonical variables (F1 and S1), as well as the second (F2 and S2), were related to some degree. Those variables in the beliefs set that correlated closely with the first canonical variable were 'quick learning' and 'simple knowledge', and to a lesser extent, 'certain knowledge', and in the approaches set, the 'deep approach', with the negative 'surface approach' correlating to a lesser extent. Taken as a pair, these variables suggest that those with immature EBs (0.32; 0.81; and 0.29) also tended to deploy a 'surface' learning approach (0.91) and a negative 'deep' approach (-0.34).

The second canonical variable in the beliefs set was composed of a negative 'simple knowledge' (-0.82) and to a lesser extent, a negative 'quick learning' (-2.1), while the corresponding canonical variant from the approaches set was composed of a 'deep' approach (0.90) and to a lesser extent, the 'surface' approach (0.39). Taken as a pair, these variables indicate that sophisticated beliefs (in relative knowledge and gradual learning) correspond to a 'deep' learning approach. Together the two canonical variables account for 68% of variance in the EBs-set, and 94% of variance in the LAs-set. Together the two beliefs variables explain 12% of the variance in the LAs-set, while the two approaches variables, taken together, overlap the variance in the EBs-set by 17%.

The findings of this research lend support to the conclusion that the analysis of the different components of participants' learning experience showed that LAs and EBs (two pairs of canonical variables accounted for the significant relationships) were interrelated. EBs and LAs were not independent but generally consistent and logically interrelated constructs; the more simplistic and naive the former, the more superficial and reproduction-oriented the latter and the more mature and sophisticated the former, the deeper and more meaning-oriented the latter.

Although these results seem to be generally congruent with those obtained in other research (Chan 2003; Cano and Cardelle-Elawar 2004; Rodriguez and Cano 2006), they provide further information, showing that not only are the two sets of measures correlated, but also that little overlap exists between them.

## CONCLUSION

The relationship between the two constructs in this study might be due to the underlying meta-cognition shared by them. This could be interpreted as demonstrating that EBs and LAs are associated but distinct elements defining students' learning experience, elements for

**Table 1: Correlations, standardised acceptable coefficients, acceptable correlations, percentages of variables and redundancies between EBs and LAs variables**

| | Acceptable | | Variables | | |
|---|---|---|---|---|---|
| | First: Cor | Coef | Second: Cor | Coef | |
| EBs | (F1) | | (F2) | | |
| Quick learning | 0.52 | 0.32 | -0.39 | -0.21 | |
| Simple knowledge | -1.90 | -1.49 | -0.88 | -0.82 | |
| Fixed ability | 0.82 | 0.81 | -1.19 | -0.07 | |
| Certain knowledge | 0.37 | 0.29 | 0.31 | 0.12 | |
| % of variables | 29% | 25% | | | Total = 68% |
| Redundancy | 0.08 | 0.04 | | | Total = 12% |
| LAs | (S1) | | (S2) | | |
| Deep | -0.34 | -2.1 | 0.89 | 0.91 | |
| Surface | 0.90 | 0.87 | 0.24 | 0.39 | |
| % of variables | 52% | 47% | | | Total = 94% |
| Redundancy | 0.09 | 0.04 | | | Total = 17% |
| Correlation | 0.39 | 0.27 | | | |

Cor = Correlations of acceptable variables with original variables
Coef = Standardised acceptable variable coefficients
F1/F2 = acceptable variables for first set of variables (CNVRF1; CNVRF2)
S1/S2 = acceptable variables for first second set variables (CNVRS1; CNVRS2)

which researchers have identified a number of different sources. While EBs is influenced by variables such as home, formal education and age, LAs seem to be more 'relational', since they depend on students' perceptions of their teaching–learning environments.

In this study, the 'deep' learning approach variable has the strongest influence on the canonical variant of the LAs-set. On the other hand, the 'complex-constructivist' assessment variable has the strongest influence on the canonical variant of the EBs-set. Briefly, it can be interpreted that teachers who use complex–constructivist assessment type, create an atmosphere for their students to apply deep LAs. Our modern technological advance society requires people who apply 'deep' learning approach to be successful in real life. This is why teachers should use assessment methods which aim to assess higher order thinking skills.

This finding indicates that the 'deep' learning approach positively correlates with critical thinking. In this respect, using assessment methods which aim to assess lower order thinking skills lead students to apply 'surface' learning approaches. In other words, students who use the 'deep' learning approach have a tendency to prefer complex-constructivist assessment. This entails that if assessment activities require 'deep' learning, students will prefer the 'deep' learning approach, on the other hand, if it requires 'surface' learning they will prefer the 'surface' learning approach.

## RECOMMENDATIONS

In summary, student teachers' learning experience included different but related elements, namely EBs and LAs. Follow-up studies of these students to discover how the university teaching–learning environment impacts on their learning experience and academic performances are recommended as they would give us a better understanding, enabling academic staff to provide greater scaffolding support for postgraduate students. The findings confirm a positive relationship between knowledge assumptions and learning approaches amongst participants and suggest that universities should provide the necessary support to foster the development of a mature learning experience amongst their students. The study provided substantial justification for looking at epistemological be-

liefs in the study of learning approaches among university students.

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