EPISTEMOLOGICAL BELIEFS AS PREDICTOR OF THE INSTRUCTIONAL PRACTICES OF SCIENCE TEACHERS IN PERAK

NORANIZA BINTI JAFFRY

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ABSTRACT

This study aimed to determine the epistemological beliefs among science teachers in Perak and to determine if the epistemological beliefs is good predictors of instructional practices. The study was also designed to determine if the teaching and learning conception is a good predictor of instructional practices among science teachers in Perak. Quantitative approach was used for this study. The study involved 231 Science teachers from primary schools in Perak districts. Three types of research instruments were employed which are Epistemological Beliefs Questionnaire (EBQ), Teaching and Learning Conceptions Questionnaire (TLCQ) and Instructional Practices Questionnaire (IPQ). The validation procedure of the epistemological beliefs instrument involved validity, reliability and construct validity test. Data were analysed using descriptive and multiple regression analysis. The finding showed that Science teachers possessed positive epistemological beliefs (M= 3.88, SD = 0.32). A great number of Science teachers in Perak preferred to use constructivist teaching conception (M= 4.40, SD = 0.36) than traditional teaching conception (M= 3.47, SD= 0.75). Teaching and learning conception holds by Science teachers is a good predictor of the instructional practices. Analysis of the regression indicated that standard contemporary practice (β= 0.47, $p< .01$) and focused instruction (β= 0.35, $p< .01$) was predicted by constructivist teaching conception. Meanwhile, epistemological beliefs is a good predictor of teaching practices. Analysis of regression coefficients indicated that teaching practices was predicted by learning effort (β= 0.24, $p<.01$) and certainty knowledge (β=0.17, $p< .01$). In conclusion, the study shows that epistemological beliefs is a good predictor of learning practices. The implication of the study is that the findings of this study could be used to predict the institutional practices of Science teachers.

KEPERCAYAAN EPISTEMOLOGI SEBAGAI PERAMAL KEPADA AMALAN PENGAJARAN GURU SAINS DI NEGERI PERAK

ABSTRAK

Kajian ini bertujuan untuk mengkaji tentang kepercayaan epistemologi dalam kalangan guru Sains di Perak dan untuk menentukan sama ada kepercayaan epistemologi adalah peramal yang baik dalam amalan pengajaran. Kajian ini juga dijalankan untuk menentukan sama ada konsep pengajaran dan pembelajaran adalah peramal yang baik dalam amalan pengajaran dalam kalangan guru Sains di Perak. Pendekatan kuantitatif telah digunakan untuk kajian ini. Sejumlah 231 guru Sains dari sekolah-sekolah di daerah Perak telah dipilih menggunakan kaedah pensampelan pelbagai peringkat. Tiga jenis instrumen penyelidikan yang digunakan ialah Kepercayaan Epistemologi (EBQ), Konsep Pengajaran dan Pembelajaran (TLCQ) dan Amalan Pengajaran (IPQ). Prosedur pengesahan kepercayaan epistemologi yang dijalankan melibatkan proses- proses berikut kesahan, kebolehpercayaan dan kesahan konstruk. Data dianalisis menggunakan analisis deskriptif dan regresi berganda. Dapatan kajian menunjukkan bahawa guru Sains mempunyai kepercayaan epistemologi yang positif (M= 3.88, SD = 0.32). Sebilangan besar guru Sains di Perak lebih suka menggunakan konsep pengajaran konstruktivis (M= 4.40, SD = 0.36) berbanding konsep tradisional (M= 3.47, SD= 0.75). Konsep pengajaran dan pembelajaran yang dimiliki oleh guru- guru Sains merupakan peramal yang baik kepada amalan pengajaran guru di dalam kelas. Analisis secara regresi menunjukkan bahawa amalan pengajaran standard kontemporari ($\beta = 0.47$, $p< .01$) dan arahan berfokus ($\beta = 0.47$, $p< .01$) merupakan peramal kepada konsep konstruktivis. Manakala, kepercayaan epistemologi merupakan peramal yang baik kepada amalan pengajaran. Analisis regresi menunjukkan bahawa amalan pengajaran merupakan peramal kepada usaha ($\beta = 0.24$, $p<.01$) dan kepastian pengetahuan ($\beta =0.17$, $p< .01$). Kesimpulannya, kajian ini menunjukkan bahawa kepercayaan epistemologi adalah peramal yang baik kepada amalan pembelajaran. Implikasi kajian ini ialah dapatan kajian ini boleh digunakan untuk meramal amalan pembelajaran institusi guru Sains.

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A	EBQ	Epistemological Beliefs Questionnaire
B	TLCQ	Teaching and Learning Conceptions Questionnaire
C	IPQ	Instructional Practices Questionnaire
D	SPSS	Statistical Packages for the Social Science

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Research on epistemological beliefs and its contribution to education has been matter of interest to many researches (Arslantaş, 2015; Aypay. A, 2010 and Chai, 2010). This is because epistemological beliefs able to affect teachers' teaching processes and students' achievement (Arslantaş, 2015). Hence, epistemological beliefs become important in teaching and learning. Epistemology research started with Piaget's work on genetic epistemology in 1950 where he defined genetic epistemological beliefs as the process of knowledge. Therefore, there is no definitive state of knowledge because knowledge always involves continual process of construction and reorganisation (Ismail, Hassan, Muhamad, Ali, & Konting, 2013).

Meanwhile, Piaget (1950) stated that research regarding epistemology in education is psychological where it focused on cognitive and metacognitive processes. Teachers need to understand how students approach to learning whether as an active learners or passive learner (Hofer, 2001). Thus, teachers will apply the suitable strategy to deliver the knowledge successfully. Science Education plays a major role in making Malaysia to be a developed country by 2020. Therefore, Science is a compulsory subject that being taught from preschool until upper secondary school. Science consists of three main components which are knowledge, science process skills and science manipulative skills. Students need to master in critical and creative thinking in order to be able to solve problems involving science questions in the classroom. Teachers have to provide a clear and accurate description of what is being learned by the students in order to show the ways to solve specific academic tasks. Therefore, teachers must assess the needs of specific learning and apply the appropriate strategies and activities to the students during teaching and learning processes. Teachers as the medium of transferring the knowledge should always review, explain and check for students' understanding and reteaches if necessary. They must be able to use variety of strategies in transferring the knowledge as well as getting the students' attention. If the teachers play their roles effectively then products to be produced can meet the educational needs. However, some findings found that many teachers do not practice constructivism in their classrooms, despite the investment and other commitments are provided (Kang, Brian, & Ricca, 2010).

Epistemological perspectives play an important role in the academic field. For example, epistemological beliefs may affect students' academic achievement (Arslantaş, 2015), metacognition (Yilmaz-Tüzün & Topcu, 2010) and learning

conceptions and approaches to study (Zhu, Valcke, & Schellens, 2008). In an epistemological context, beliefs constitute in what individuals knows, beliefs about something, and how it becomes a part of and able to effect cognitive processes (Hofer & Pintrich, 1997). The study of epistemology is important as it can affect the actions taken by a person in the process of teaching and learning. Epistemological beliefs are able to influence student's understanding and learning approaches. For example, Brownlee & Berthelsen (2005) indicate that individuals who have relativistic epistemological beliefs will apply deep learning approaches that generate good answers that are linked to the prior knowledge.

Although each trainee teacher is given the same training during their pre-service learning, they still practice different teaching practices in the classroom. This happened because the process of change as well as teaching techniques in school is influenced by the teachers' personal beliefs. Belief means doing works according to the priority (Pintrich & de Groot, 1990). The approach in teaching and learning concepts is influenced by teacher's beliefs (K. W. Chan & Elliott, 2004). Pre-service teachers gain classroom teaching experience through their instructor and the experience they have (Stuart & Thurlow, 2000). Thus, identifying teacher's epistemological beliefs and instructional practices is necessary to make sure teacher uses an appropriate teaching strategy in the classroom. Constructivist teaching strategies cannot be implemented if the pre-service teacher's beliefs are not constructed according to constructivism (Darling-Hammond, 2006). Therefore, constructivist teaching needs to be exposed to all teachers to rebuild their beliefs about teaching.

Epistemological beliefs can influence teaching and learning concepts among pre-service teachers (Cheng, Chan, Tang, & Cheng, 2009). Teachers whose beliefs on constructivist conception believe that knowledge is tentative and changeable meanwhile ability is not inborn. On the other hand, teachers whose beliefs on traditional conception believe that knowledge is certain and does not change.

1.2 Back ground of the Study

Epistemological belief is one of the solutions to promote effective teaching and learning. According to Brownlee & Berthelson (2005), epistemological belief is a personal factor that can affect learning activities. Epistemology beliefs will explain how we think about something and determine whether the knowledge is true or wrong. Therefore, epistemology is able to help people to acquire knowledge.

Science as a compulsory subject in school is also one of the keys of science and technology developments in a country. As the medium of science and technology developments, Science teachers should play their role by planning the teaching and learning effectively. According to Liu (2010), in order to educate students to become literate with Science, teachers should plan the process of delivering information in the classroom effectively to ensure that knowledge can be communicated in a way that can attract students to continue their study in the field of science in higher education especially.

Research on epistemology is able to give a better explanation on issues in science education compared to research on the attitudes and interests towards science as it is only describe about perceptions and expectations of teachers and students towards science. According to Chan & Elliott (2004), teachers' epistemological beliefs are able to influence teachers' conceptualization of teaching. Therefore, epistemological beliefs help the teachers to choose appropriate strategies for the teaching and learning process.

1.3 Statement of Problems

While many researches support the fact that epistemological beliefs play important role in the academic fields (Arslantaş, 2015; Zhu et al., 2008 & Yilmaz-Tüzün & Topcu, 2010), research of epistemological beliefs are still limited in the context of Asian countries. Researcher has noticed that available literature and instruments regarding epistemological beliefs are based on framework and studies conducted in the western countries (Chan, K. W. 2000). With the limited previous research of epistemological beliefs in the Asian society, it is impossible to fully understand the Science teachers' epistemological beliefs.

Besides, students in standard six in Malaysia will sit for their *Ujian Penilaian Sekolah Rendah* (UPSR) at the end of year. Therefore, Science teachers in Malaysia are mostly directing their students to achieve a good result in the examination especially in Science. Therefore, the teachers struggle to finish and complete the syllabus that has been fixed in school as preparation for the students to sit for UPSR examination. It is

obvious from the previous introduction that there is real need to investigate Science teachers' epistemological beliefs and find out how far it affects their level of epistemological beliefs and instructional practices in teaching and learning processes.

Teachers with the naive epistemology apply guided instructional practices rather than teachers with sophisticated beliefs may not or used less guided instructional practices (Muis, 2004). Science teacher is encouraged to use constructivist teaching techniques in teaching and learning processes. However, many of them do not practice constructivism in their classrooms, despite the investment and other commitments are provided (Kang et al., 2010). Some of the teachers are still using traditional teaching techniques to deliver information in the classroom. What is the factor that contributes to the cause of the teachers is still using these traditional teaching techniques? Cheng et al.,(2009) states that teachers' beliefs are able to influence the teaching strategies and teaching conception in the classroom. Chai, Teo, & Lee (2010) found that teachers in Singapore are more relativist, but yet applied knowledge transmission instructional teaching methods. Al-Amoush, Usak, Erdogan, Markic, & Eilks (2013) found that in service and pre-service teachers in Turkish believe in traditional views in teaching and learning chemistry. Alsamie & Ismail (2005) also observe that pre-service teachers in Saudi Arabian use memorization and rehearsal techniques than critical thinking in both learning and teaching. They also hold naive epistemology beliefs and tend to apply teacher-centred teaching rather than constructivist teaching and learning practices.

Given the important association of teacher's epistemological beliefs on practice, it then seemed important to investigate the epistemological beliefs as a predictor of the instructional practices of science teachers in Perak. Many previous researches have

been done involving pre-service teachers and in- service teachers (Cheng, Chan, Tang, & Cheng, 2009). However, researchers only found small number of studies regarding epistemology beliefs that involved Science teachers in western society (Feucht & Bendixen, 2010; Kang & Wallace, 2005). Meanwhile, in the Asian society, researchers only found small number of studies regarding epistemological beliefs that involved with in- service teachers and pre- service teachers (Chan & Elliott, 2002; Chai, 2010; Chai, Khine, & Teo, 2006; Chai, Teo, & Lee, 2010). Besides, researchers also found very limited studies regarding epistemological beliefs in Malaysia. With the limited researches of epistemological beliefs in Malaysia specifically, epistemological beliefs of Science teachers will remain as speculations.

Therefore in the present study, researcher will discover the epistemological beliefs among Science teachers in Perak. Results from this study are expected to be used to encourage teachers to improve the process of delivering information in the classroom, encouraging them to practice the constructivist teaching strategies in their teaching practices.

1.4 Objectives of the Study

This study is aimed to investigate the epistemological beliefs as the predictors of teaching practices among science teachers in Perak.

The objectives of this study are:

1. To determine the level of epistemological beliefs among Science teachers in Perak.
2. To determine what is the teaching and learning conception among Science teachers in Perak.
3. To determine if the teaching and learning conception among Science teachers in Perak is a good predictor of instructional practices among Science teachers in Perak.
4. To determine if the epistemological beliefs is a good predictor of instructional practices among Science teachers in Perak.

1.5 Research Questions

1. What is the level of epistemological beliefs among Science teachers in Perak?
2. What is the teaching and learning conception among Science teachers in Perak?
3. Do the teaching and learning conception held by Science teachers in Perak is a good predictor of instructional practices among Science teachers in Perak?
4. Does the epistemological beliefs is a good predictor of teaching practices among Science teachers in Perak?

1.6 Importance of the Study

The importance of the present study is explained as below:

1. To gain information regarding teachers' epistemological beliefs in Malaysia society in order to understand about the teaching practices in the classroom. The

findings of this study can add evidence to the field of epistemological belief research and how epistemological beliefs have been translated into teaching and learning practices in school. Teacher education programs can foster certain epistemologies among pre-service teachers to deliver the best results in the classroom (Brownlee, Purdie, & Boulton-Lewis, 2001).

2. To gain information regarding instructional practices that teachers apply in the classroom. Chang (2006) states that an analysis of student and performance analysis needs to be undertaken before the instructional practices are implemented in improving the teaching practices and educator. The findings of the study can also add information to the developers of professional development programs in helping them to make decisions about Science teachers before any instructions is made.

1.7 Conceptual Framework

Epistemological beliefs of teachers able to influence tasks given in the classroom and pedagogical practices (Hofer, 2001). Figure 1.0 shows a conceptual framework which suggests that epistemological beliefs and pedagogical beliefs of teachers are able to affect the teachers' instructional practices. The results of the study will reveal about teachers' conceptions of teaching and learning, whether it is traditional or constructivist. Based on case studies involving in service teachers in Singapore, Chai (2010) found that teachers are lack of epistemological beliefs and apply traditional concepts in teaching and learning processes causing the students becoming passive members in the class. Therefore, teachers who apply constructivist concepts in the teaching and learning

process will produce student-centred learning where students becoming active members in the class.

Meanwhile, conceptions of teaching and learning reflect pedagogical beliefs as knowledge transmission or knowledge construction (Lee, 2013). Teachers whose beliefs on teacher-centred and content-oriented are always apply didactic teaching practices. Meanwhile, teachers who apply student-centred apply constructivist teaching practices (Howard, McGee, Schwartz, & Purcell, 2014). Instructional practices can be divided into three types which are standard contemporary practice, focused instruction practice and flexible grouping practice (Wahlstrom & Louis, 2008). According to Wahlstrom and Louis (2008), standard contemporary practice is similar to student-centred teaching practices that emphasized on student learning. Meanwhile, focused instruction practice is based on specific learning activities that the teacher has set. The teacher will make sure the students take part in the activities that has been set during the learning processes. Flexible grouping practice is a teaching practice that suitable to use with different level of students. This kind of teaching practices emphasizes on cooperative learning environment.

Teachers' epistemological beliefs and instructional practices are closely interconnected. Bandura, (1986) stated that epistemological beliefs are the best indicator of teacher actions in the teaching and learning process. The present study will provide information regarding instructional practices frequently used by teachers in the classroom.

Based on the conceptual framework, teachers' epistemology may influence instructional practices in the classroom. Every student has their own existing epistemology beliefs and theories that lead to interpretations of instruction. According to Chan and Elliot (2004), epistemological beliefs may affect teaching and students learning in the classroom. Epistemology is able to help individual in determine the truth as it related to the individual's sense about knowledge, how knowledge is gained, and validity of knowledge. Guven (2012) states that in order for individuals to be effective in learning process they should have efficient learning skills and possess mature epistemological beliefs. According to Schommer, A & Duell (2013), "epistemological beliefs involve learners' theories about knowing, the nature of knowledge, and knowledge acquisition".

Constructivist teaching practice has become the main practice in the teaching of Science, particularly engineering. This teaching practice and it seeks to provide opportunities for students to solve problems that are the "real world" in a learning environment that is free without instructions from the teacher. According to Wahlstrom & Louis (2008), constructivist teaching practice in attempts to stimulate the students to understand the subject matter assigned to them in the assignment. A study conducted by Tsai (2000) and Tsai and Chuang (2005) found that students with constructivist beliefs tend to perform tasks in groups and show a preference towards learning environment where they can use their existing knowledge before starting and terminating a task. Besides, when more students are showing greater confidence in the epistemology of science, the constructivists of students will be increasing (Chan and Elliott 2004).

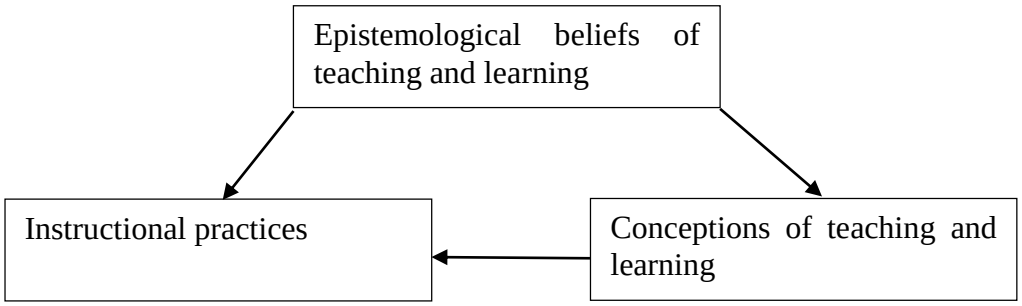

Figure 1.0. Conceptual Framework. Adapted from Lee, J. C. (2013)

1.8 Definitions of Terms

This section contains definition of terms which is often used by researcher throughout this dissertation. The definition provided is based on the definition that has been used by previous researchers in the studies they have carried out.

1.8.1 Epistemological Beliefs

According to Hofer (2002), epistemology beliefs are human's beliefs about knowing and knowledge. Epistemology is defined as a source, nature, boundaries, methods and justifications of humans about knowledge. Epistemology belief seeks for answer to the question such as "how do we know?". The nature of epistemology beliefs including concept formation, validity senses, reasoning and logical thinking, ideas, memory, emotions and everything connected with mental and intellectual. Meanwhile, epistemology belief can be influenced by peoples' knowledge from past experiences

(Hutchison & Hammer, 2010). This happens when people draw a conclusion or make choices based on their past experiences which perceived to be similar. Therefore, in the present research, respondents are asked to answer a questionnaire to identify their level of epistemological beliefs.

1.8.2 Instructional Practices

Instructional practices can be define as teaching strategy that the teacher uses to achieve the learning objective of the lesson (Wahlstrom & Louis, 2008). Instructional practices are applied to promote student's learning. In this study, instructional practices can be defined as the techniques of instructions that teacher uses to guide students towards new understanding and the practices that the teacher applies when she or he works with the students in groups. Instructional practices cannot change the subject matter. However, the medium of instruction can be changed or manipulated to ensure better understanding among the students.

The first instructional practise is flexible grouping. Flexible grouping is a technique where teacher designs teaching and learning strategy based on the instructional purposes and students' characteristics. Flexible grouping is consistency with student's achievement or student's levels of academic ability. The students are grouped according to different levels of academic ability. This type of instructional practice is to make instruction more responsive in classroom where the students are working at the various levels. This instructional practice is able to promote cooperative learning environment rather than individual environment.

The second instructional practice is standard contemporary practice. This instructional practice is designed based on the specific learning outcomes. Through this instructional practice, students are able to develop cognitive strategies that help them to develop higher level of thinking individually. The questions technique is used to direct students' attention towards the specific goals, but in the same times they still have many choices and interesting things to think about. Meanwhile, the third instructional practice is focused instruction practice. It is designed using both combination of teachers guided and student's exploration. Even though teachers use guided learning activities, the students are still allowed to explore and discuss among themselves to develop new understanding.

1.9 Limitation

There are some limitations of this study. The study is only conducted in the state of Perak and only involves teachers who teach Science subject in primary school. To make a better understanding about epistemological beliefs, this study can be carried out with the involvement of all Science teachers in Malaysia. Therefore, teachers' epistemology can be explained better. Besides, the instrument that is used to measure Science teachers' epistemology needs to be constructed in the context of education in Malaysia. This is because previous instruments were constructed according to the education cultural of foreign countries.