



## Adaptation of the Epistemological Belief Questionnaire about Teaching and Learning of Preservice Physics Teacher: Preliminary Research

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**Abstract:** This study aims to obtain an instrument of teacher beliefs about learning and teaching in hybrid learning in the post-COVID-19 (New Normal) era. In addition to producing a questionnaire instrument, this study looks for the relationship of belief to learning and learning with Confirmatory Factor Analysis (CFA). The research subjects were selected through a random sampling technique (through a lottery) by several teachers/prospective teachers of physics education at schools and in higher education institutions. Structural equation modeling (SEM) analysis was performed using AMOSS v26 using a strong categorical data estimator. The SEM results show the teaching and learning conceptions questionnaire in the marginal fit category (RMSEA) poor fit (NFI, RFI, IFI, TLI, and CGI), in addition, it is shown that the indicators have good internal consistency but lack formation in the latent variance variable. Meanwhile, the results of the SEM Epistemological Beliefs Questionnaire are in the poor fit category, both seen from the RMSEA and NFI, RFI, IFI, TLI, and CGI. Indicators of Fixed ability, learning effort, Authority, and Certainty Knowledge have good internal consistency, while Authority internal consistency is not good. The variance on the Epistemological belief questionnaire extracted from the indicators is greater for the formation of latent variables.

**Keywords:** Adaption, Epistemological belief about teaching-learning questionnaire, Preservice physics teacher

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## INTRODUCTION

The concept of epistemological belief was first put forward by Perry in 1968 and reiterated by Schommer in 1998 by stating that the concept of epistemological belief consists of five dimensions, namely: certainty of knowledge – from absolute to temporary, knowledge structure (structure of knowledge) – simple to complex, source of knowledge – comes from experts or through a thought process, control of knowledge – learning ability is innate or learning ability can change, and speed of knowledge acquisition (speed of knowledge acquisition) – knowledge is obtained quickly or not all knowledge can be gradually acquired (Yilmaz & Sahin, 2011).

While the scale developed by Schommer, Chan & Elliot (2004) develops an epistemological belief scale consisting of only four dimensions, namely: innate/fixed ability, learning effort/process, authority/expert knowledge, and certainty knowledge. On this scale, Chan & Elliot combines the structure and speed of knowledge acquisition into a new scale, namely learning effort/process. Meanwhile, the other three dimensions of the epistemological belief scale developed by Chan & Elliot have similar characteristics to the scale developed by Schommer. As quoted by Lee et al. (2013) the innate/fixed ability scale measures the teacher's belief in whether a person's ability is innate and cannot be changed (fixed/changeable). Authority/expert knowledge measures the teacher's confidence in seeing whether knowledge is transferred by someone with higher authority and expertise or acquired through a process of justification and reasoning on each individual. And lastly, certainty knowledge measures the teacher's belief in seeing whether knowledge is something that is certain, permanent, and cannot change or is something that can change.

Epistemological belief is one of the factors that influence the concept of teaching and learning that is owned by a teacher or teacher candidate. Based on research conducted on junior high school teachers in several areas in China, Lee et al. (2013) found that innate/fixed ability and certainty knowledge were negatively correlated with constructivist teaching and learning concepts but had a positive correlation with traditional teaching and learning concepts. In contrast, the belief that teachers or experts can be criticized significantly has a positive correlation with constructivism concepts, and negatively correlates with traditional concepts. In addition, the learning effort (learning effort/process) significantly has a positive correlation with the concept of teaching and learning constructivism.

Self-regulation theory is embedded in a constructivist epistemology. Learners are considered active agents who interpret the information they receive based on what they already know and create their own meaning. In the learning process, the most important are the activities that students do to get meaning from the information they encounter. In this perspective, teachers are more effective when they teach students strategies that can help them improve their learning actions than when they simply convey or display subject matter information. Although prospective teachers tend to be exposed to constructivist epistemology in their teacher education courses, many teachers, especially beginners, do not fully understand that it is students themselves who construct their knowledge through their knowledge-building activities (Ambrose et al., 2010; Zohar, 2004). For the novice and experienced teachers who are characterized by such a view, this lack of understanding hinders the development of their self-regulatory abilities as well as teaching practices that promote self-regulation of learning in their

students (Chatzistamatiou, Dermitzaki, & Bagiatis, 2014; Kramarski & Michalsky, 2009; Perry et al., 2015).

Lonka, Joram, and Bryson (1996) investigated the relationship between formal training in educational psychology and beliefs in a constructivist epistemology. Using an open-ended questionnaire they examined participants' conceptions of learning that revolved around expertise in educational psychology. The results of their study showed that only participants who had formal training in educational psychology were able to provide a sophisticated definition of learning and suggestions on how to improve it according to constructivist epistemology. The teachers in this study were not found to provide a constructivist definition of learning – their definition was described as a theory in nature. These results were confirmed in a second study in the same report which showed significant pre-post differences in student-teacher definitions of learning before and after they took courses in educational psychology. However, this change was not reflected in the student-teacher approach to concrete problems where they were asked to suggest forms of teaching that would enhance students' ability to learn. It turned out that the participants' answers on the post-test were the same as those of the pretest. The result is a reminder of how difficult it is to translate theoretical knowledge into practice.

Research related to Self-regulation theory, especially Epistemological Beliefs about Teaching and Learning has developed and is considered important in the development of students. However, this research is little developed in Asia, especially in Indonesia. Because many measuring tools are related to Epistemological Beliefs about Teaching and Learning which are not adapted to the character of each nation. So we need a measuring tool that is in accordance with the Indonesian contest.

## METHOD

This preliminary research is focused on how to get a teacher/prospective teacher's belief instrument about learning and teaching a fit optics material. A valid belief questionnaire instrument about learning and teaching by adopting an epistemological belief questionnaire developed by Schommer (M. Schommer, 1990). We constructed a pilot version of the Beliefs about Learning and Teaching questionnaire consisting of 30 6-point Likert scales (1 Strongly Agree - 6 Strongly Disagree) items. This questionnaire was given to research subjects, namely several prospective physics education teachers in schools and tertiary institutions who were selected through the random sampling technique (through a lottery). Exploratory Factor Analysis (EFA) using SPSS Version 23.0 was used to investigate the underlying structure of the item set and to eliminate items with low factor loads.

Structural equation modeling analysis (SEM) was performed using the IBM SPSS AMOSS 26 using a robust categorical data estimator. The chi-square index usually indicates a fit if it is not significant, however, it is sensitive to sample size and, if the data size is large, the chi-square statistic may erroneously imply poor data for model fit. Thus, with large sample sizes, as in this case, a relative chi-square index, which is less dependent on sample size, is often used, with values ranging from 2 to 3 and as high as 5 (Marsh & Hocevar, 1985) used to indicate a match. . In this study, we used an index of  $2/df$  with a value less than 3.

Values above 0.92 are used for the Tucker Lewis Index (TLI) and Comparative Fit Index (CFI) (“Multivariate Data Analysis’ by Joseph F. Hair,” n.d.). Values less than 0.08 are considered acceptable for the Root Mean Square Error of Approximation (RMSEA) (Browne & Cudeck, 1992), but values smaller than 0.06 are used to indicate a match. Or it can be observed in the following table 1.

**Table 1.** Measurement of the Conformity Index/goodness

<i>Output goodness of fit statistics</i>	<b>Criteria</b>	<b>Information</b>	<b>Reference</b>
GFI, AGFI, NFI, RFI, IFI, CFI	1 ≥ 0,90	<i>Perfect fit</i> <i>Good fit</i>	(wijanto, 2008)
0 ( <i>poor fit</i> ) sampai 1 ( <i>perfect fit</i> )	0,80 - 0,90	<i>Marginal fit</i>	
	≤ 0,05	<i>Close fit</i>	(Cudeck, 1993)
RMSEA	0,05 < RMSEA ≤ 0,08	<i>Good fit</i>	(McCallum, 1996)
	0,08 < RMSEA ≤ 0,10	<i>Marginal fit</i>	
	> 0,10	<i>Poor fit</i>	
Chi-square	Sig. ≥ 0,05 (p ≥ 0,05)	<i>fit</i>	(wijanto, 2008)

## RESULT AND DISCUSSION

### Research Questionnaire Adaptation

Adaptation of the research questionnaire in the form of a questionnaire on the conception of teaching and learning, and a questionnaire on epistemological beliefs conducted by CFA (Confirmatory Factor Analysis). This CFA was conducted to see whether the data showed a match for each formation indicator in the questionnaire. The CFA model will be presented and discussed in detail in each questionnaire.

#### (a) Teaching and Learning Conception Questionnaire

The CFA model of the teaching and learning conception questionnaire is presented in Figure 1. The CFA fit indices were investigated, with the chi-square value ( $\chi^2 = 593,005$ ,  $N = 71$ ,  $sd = 404$ ,  $p = .000$ ) significantly less good. Figure 4.1 shows the fit indices that the RMSEA found to be 0.082. The RMSEA value indicates a good fit (fit), between 0 and 0.05, and if the value is in the range  $0.08 < RMSEA < 0.10$  it indicates a marginal fit. Normed Fit Indice (NFI) = .540; RFI = .504; IFI = .786; TLI = .762; CFI = .779 is a category or indicates poor fit. As a result, it is necessary to modify the model or in this case even the items in the questionnaire in each indicator to get even better scores.

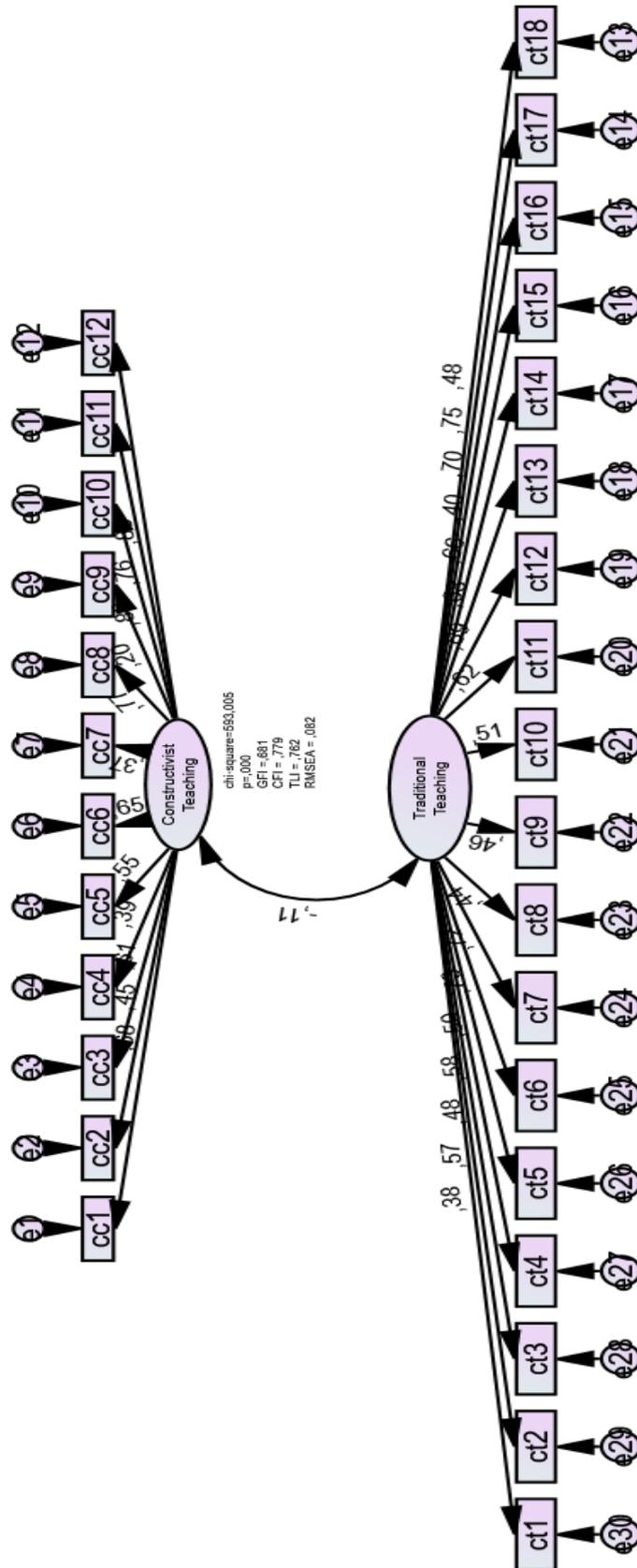


Figure 1. CFA Results on Teaching and Learning Conception Questionnaire

The research data that was carried out by CFA review on the adaptation of the Teaching and Learning Concepts questionnaire (teaching and learning conceptions questionnaire) was in the poor fit category. This has an impact on the need to modify the model or in this case even the items in the questionnaire in each indicator to get even better scores. In terms of Construct Reliability and Variance Extracted, the indicators have good consistency, but these indicators are not able to form latent variables, in this case, it occurs in both the Conception of Constructivist Teaching and Conception of Traditional Teaching.

Indicators that have not been able to form this variable can be explored by obtaining the P-Label value ( $0.05 < sig.$ ) in the Regression Weights to find out the causes or indicators that make the variable unable to be formed. The data is shown by almost all good fit indicators, some of which have indicators that cause the variance variable not to form, namely CC9 (P-Label = 0.113) with the item indicator "Different goals and expectations in learning must be applied to different students", CT15 ( P-Label = 0.007) with item indicator "I really have learned something when I can remember it later" and CT1 (P-Label 0.008) with item indicator "The main task of a teacher is to provide students with knowledge/information, assign them exercises and practice, and test their memory."

(b) Epistemological beliefs questionnaire

The CFA model of the epistemological belief questionnaire is presented in Figure 2 The CFA fit indices were investigated, with the chi-square value ( $\chi^2 = 636,757, N = 71, sd = 371, p=.000$ ) significantly less good.

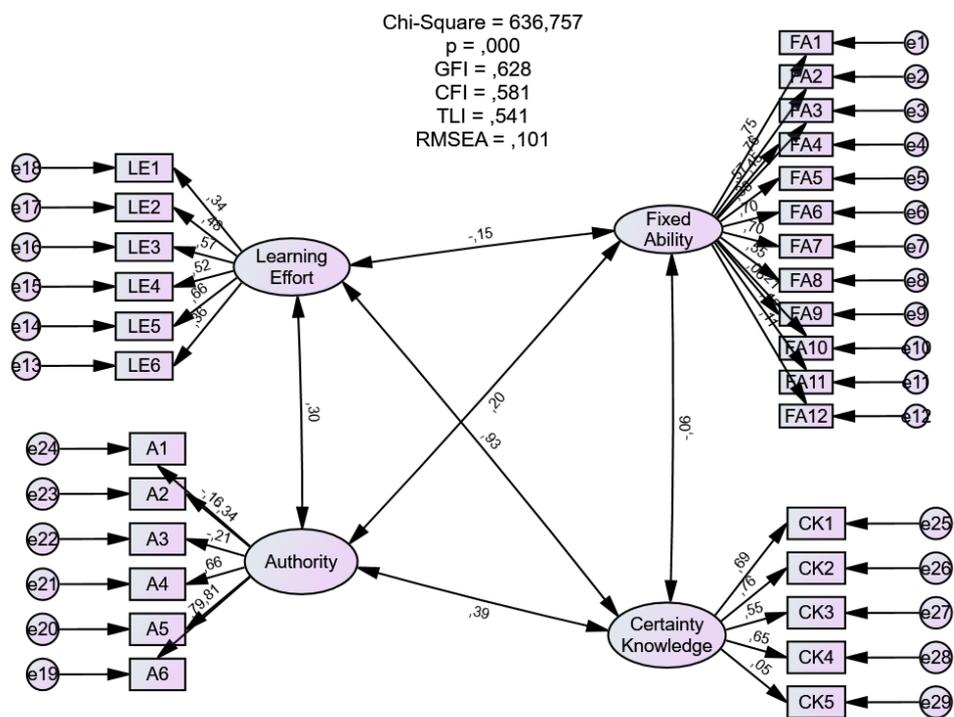


Figure 2. CFA Results on the Epistemological Belief Questionnaire

Figure 2 shows the corresponding index that the RMSEA found is 0.101. The RMSEA value indicates a poor fit, while the Normed Fit Indices (NFI) = 0.380; RFI = .330; IFI = 0.603; TLI = 0.541; CFI = 0.581 is a category or indicates a poor fit. The results of model modifications or in this case even items in the questionnaire in each indicator to get even better scores.

Research data conducted by CFA review the adaptation of the Epistemological Beliefs Questionnaire (Epistemological beliefs questionnaire) is a category or shows poor fit. As a result, it is necessary to modify the model or in this case even the items in the questionnaire in each indicator to get even better scores. This has an impact on the need to modify the model or in this case even the items in the questionnaire in each indicator to get even better scores. In terms of Construct Reliability and Variance Extracted, the indicators have good internal consistency except for Authority which has a cut-off of 0.7 which is an exception and can be interpreted as poor internal consistency. However, the variance extracted from the indicators is greater for the formation of the late variable, in this case, it occurs both in Fixed ability, Learning effort, Authority, and Certainty Knowledge.

Indicators that have not been able to form this variable can be explored by obtaining the P-Label value ( $0.05 < \text{sig.}$ ) in the Regression Weights (attachment 6) to find out the causes or indicators that make the variable unable to be formed. The data is shown by almost all indicators that cause the variance not to form, namely FA9 (P-Label = 0.66) with the item indicator "If people can't understand something immediately, they have to keep trying", FA10 (P-Label = 0.104) with the item indicator "Knowing how to learn is more important than the facts obtained", FA11 (P-Label = 0.366) with the item indicator "A person learns a little if they don't work hard", FA12 (P-Label = 0.404) with the item indicator "Understanding course materials and thought processes are more important than acquiring knowledge/facts everyone needs to learn how to learn", LE5 (P-Label = 0.008) with item indicator "If someone tries hard enough, then he or she will understand the topic of the material", LE4 (P-Label = 0.014) with item indicator "Progress takes a lot of work", LE3 (P-Label = 0.011) with item indicator "How much you earn from your learning largely depends on your efforts", LE2 (P-Label = 0.017) with the item indicator "Learning something very well takes a long time or a lot of effort", LE1 (P-Label = 0.047) with the item indicator "People will learn better if they focus more on the understanding process than facts to be obtained", A1 (P-Label = 0.218) with the item indicator "Sometimes I do not believe the facts in textbooks written by the authorities", A2 (P-Label = 0.01) "Even advice from experts should frequently asked" with item indicator, A3 (P-Label = 0.117) with "item indicator I often wonder how many experts really know", and CK5 (P-Label 0.687) with item indicator "Scientific knowledge certain and unchanging."

#### Construct Reliability and Variance Extracted Teaching and Learning Concepts Questionnaire

The calculation results show that the Conception of Constructivist Teaching variable has a construct reliability value of 0.873, Conception of Traditional Teaching 0.901. The construct reliability value of the two variables is greater than the cut-off value of 0.7, so the indicators have good internal consistency.

Then for the variance extracted value, the Conception of Constructivist Teaching perceptions has a value of 0.390, Conception of Traditional Teaching has a value of 0.346. The variance extracted value will be smaller than the construct reliability value. Because the two variables obtained a value of variance extracted  $< 0.50$ , this is interpreted as the variance extracted from the indicators is smaller for the formation of latent variables.

#### Construct Reliability and Variance Extracted Epistemological beliefs questionnaire

The calculation results show that the Fixed ability variable has a construct reliability value of 0.765, Learning effort 0.658, Authority 0.372, and Certainty Knowledge 0.692. The value of construct reliability 3 of the 4 variables is greater than the cut-off value of 0.7 then the indicators have good internal consistency, except for Authority which has a cut-off of 0.7 which is an exception and can be interpreted as poor internal consistency.

Then for the variance extracted, the Fixed ability has a value of 0.265, Learning effort 0.252, Authority 0.317, and Certainty Knowledge 0.354. The variance extracted value will be smaller than the construct reliability value. Because the two variables obtained a value of variance extracted  $< 0.50$ , this is interpreted as the variance extracted from the indicators is greater for the formation of latent variables.

## CONCLUSION

The results of the SEM Epistemological Beliefs Questionnaire are in the poor fit category indices were investigated, with the chi-square value ( $\chi^2 = 636,757$ ,  $N = 71$ ,  $sd = 371$ ,  $p = .000$ ) significantly less good. But, from the RMSEA value indicates a poor fit (0.101) and while the Normed Fit Indices (NFI) = 0.380; RFI = .330; IFI = 0.603; TLI = 0.541; CFI = 0.581 is a category or indicates a poor fit. Indicators of Fixed ability, learning effort, Authority, and Certainty Knowledge have good internal consistency, while Authority internal consistency is not good. The results of model modifications or in this case even items in the questionnaire in each indicator to get even better scores. The variance on the Epistemological belief's questionnaire extracted from the indicators is greater for the formation of latent variables.

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