# Identification of Problem-based learning components and their effects on graduates' competencies

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Kassel, January 2014

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# Abstract

This study investigated the relationship between higher education and the requirement of the world of work with an emphasis on the effect of problem-based learning (PBL) on graduates' competencies.

The implementation of full PBL method is costly (Albanese & Mitchell, 1993; Berkson, 1993; Finucane, Shannon, & McGrath, 2009). However, the implementation of PBL in a less than curriculum-wide mode is more achievable in a broader context (Albanese, 2000). This means higher education institutions implement only a few PBL components in the curriculum. Or a teacher implements a few PBL components at the courses level. For this kind of implementation there is a need to identify PBL components and their effects on particular educational outputs (Hmelo-Silver, 2004; Newman, 2003). So far, however there has been little research about this topic.

The main aims of this study were: (1) to identify each of PBL components which were manifested in the development of a valid and reliable PBL implementation questionnaire and (2) to determine the effect of each identified PBL component to specific graduates' competencies. The analysis was based on quantitative data collected in the survey of medicine graduates of Gadjah Mada University, Indonesia. A total of 225 graduates responded to the survey.

The result of confirmatory factor analysis (CFA) showed that all individual constructs of PBL and graduates' competencies had acceptable GOFs (Goodness-of-fit). Additionally, the values of the factor loadings (standardize loading estimates), the AVEs (average variance extracted), CRs (construct reliability), and ASVs (average shared squared variance) showed the proof of convergent and discriminant validity. All values indicated valid and reliable measurements.

The investigation of the effects of PBL showed that each PBL component had specific effects on graduates' competencies. Interpersonal competencies were affected by Student-centred learning ($\beta$ = .137; $p$ < .05) and Small group components ($\beta$ = .078; $p$ < .05). Problem as stimulus affected Leadership ($\beta$ = .182; $p$ < .01). Real-world problems affected Personal and organisational competencies ($\beta$ = .140; $p$ < .01) and Interpersonal competencies ($\beta$ = .114; $p$ < .05). Teacher as facilitator affected Leadership ($\beta$ = 142; $p$ < .05). Self-directed learning affected Field-related competencies ($\beta$ = .080; $p$ < .05). These results can help higher education institution and educator to have informed choice about the implementation of PBL components. With this information higher education institutions and educators could fulfil their educational goals and in the same time meet their limited resources.

This study seeks to improve prior studies' research method in four major ways: (1) by indentifying PBL components based on theory and empirical data; (2) by using latent variables in the structural equation modelling instead of using a variable as a proxy of a construct; (3) by using CFA to validate the latent structure of the measurement, thus providing better evidence of validity; and (4) by using graduate survey data which is suitable for analysing PBL effects in the frame work of the relationship between higher education and the world of work.

**Keywords**: Problem-based learning, PBL, Competencies, Graduates' competencies, Graduate survey, Confirmatory factor analysis, Structural equation modelling.

# Zusamenfassung

Diese Studie untersucht die Beziehung zwischen der Hochschulausbildung und den beruflichen Anforderungen mit dem Schwerpunkt „Effekte des Problembasierten Lernens (PBL) auf die Kompetenzen der Absolventen“.

Die Durchführung einer vollständigen PBL-Methode ist aufwendig (Albanese & Mitchell, 1993; Berkson, 1993; Finucane , Shannon, & McGrath , 2009). Die Durchführung vom PBL in weniger umfangreichen Lehrplanmethoden ist in einem breiteren Kontext allerdings mehr erreichbar (Albanese, 2000). Dies bedeutet, dass die Hochschulen nur wenige PBL - Komponenten in den Lehrplänen implementieren oder nur wenige PBL-Komponenten werden vom Lehrer in den Seminaren implementiert. Bei einer solchen Durchführung ist es notwendig, die PBL-Komponenten und deren Effekte für bestimmte Bildungsergebnisse zu identifizieren (Hmelo -Silver, 2004; Newman, 2003). Bisher gibt es jedoch nur wenig Forschung zu diesem Thema.

Die wichtigsten Ziele dieser Studie waren: (1) PBL-Komponenten zu identifizieren, die bei der Entwicklung eines PBL-Fragebogens umgesetzt wurden, (2) die Effekte jeder identifizierten PBL-Komponente auf bestimmte Kompetenzen der Absolventen zu messen. Eine Umfrage von Absolventen der medizinischen Fakultät der Gadjah Mada University, Indonesien, wurde durchgeführt und die erhobenen quantitativen Daten wurden analysiert. Insgesamt haben 225 Absolventen an der Umfrage teilgenommen.

Das Ergebnis der konfirmatorischen Faktorenanalyse (CFA) zeigte, dass alle einzelnen Konstrukte von PBL und von den Kompetenzen der Absolventen akzeptable GOFs (Goodness-of-fit) hatten. Zusätzlich haben die Werte der Faktorladungen (standardized loading estimates), die AVEs (average variance extracted), CR (construct reliability) und ASV (average shared squared variance) eine konvergente und diskriminante Validität nachgewiesen. Allen Werten liegen gültige und zuverlässige Messungen zu Grunde.

Die Untersuchung der Effekte von PBL zeigten, dass jede PBL-Komponente spezifische Auswirkungen auf die Kompetenzen der Absolventen hat. Interpersonelle Kompetenzen und auch die Kleingruppenkomponenten ($\beta$= 0,078, $p < .05$) wurden durch das studentenzentrierte Lernen beeinflusst ($\beta$= 0,137, $p < .05$). Probleme als Stimulus beeinflussen die Führungsfähigkeit ( $\beta$ = 0,182, $p < .01$). Real-world Probleme beeinflussen die Personal - und Organisationskompetenzen( $\beta$ = 0,140, $p < .01$) und die interpersonellen Kompetenzen ($\beta$ = 0,114, $p < .05$). Lehrer als Vermittler beeinflussen die Führungsfähigkeit ($\beta$ = 142, $p < .05$). Selbstgesteuertes Lernen beeinflusst die feldbezogenen Kompetenzen ($\beta$ = 0,080, $p < .05$).

Diese Ergebnisse können Hochschulen und Lehrenden helfen, die Wahl über die Umsetzung der PBL-Komponenten informiert zu treffen. Mit diesen Informationen können Hochschulen und Lehrende ihre pädagogischen Ziele besser zu erfüllen und zur gleichen Zeit ihre begrenzten Ressourcen zu berücksichtigen.

Diese Studie soll die vorherigen Studien der Forschungsmethode in vier Hauptwegen verbessern: (1) durch die Identifizierung der PBL-Komponenten, die auf den Theorien und den empirischen Daten basieren, (2) durch die Verwendung latenter Variablen im Strukturgleichungsmodell statt der Verwendung einer Variable als Proxy eines Konstrukts, (3) durch die Verwendung von CFA, um die latente Struktur der Messung zu bestätigen, um

somit einen besseren Beweis der Gültigkeit zu erhalten; und (4) unter Verwendung der Daten der Absolventenbefragung, die für die Analyse von PBL-Effekte im Rahmen der Beziehung zwischen der Hochschulbildung und der Welt der Arbeit geeignet sind.

Stichwörter: Problembasiertes Lernen, PBL, Kompetenzen, Absolventen, Absolventenbefragung, konfirmatorische Faktorenanalyse, Strukturgleichungsmodellierung

# Nomenclature

| | |
|---|---|
| ASV | Average shared squared variance |
| AVE | Average variance extracted |
| CFA | Confirmatory factor analysis |
| CFI | Comparative fit index |
| CR | Construct/composite reliability |
| GOF | Goodness-of-fit |
| HEI | Higher education institution |
| PBL | Problem-based learning |
| RMSEA | Root mean square error of approximation |
| SCL | Student-centred learning |
| *SD* | Standard deviation |
| SDL | Self-directed learning |
| SEM | Structural equation modelling |
| UGM | Universitas Gadjah Mada |
| $\chi^2$ | Chi-squared |
| *df* | Degrees of freedom |
| *M* | Mean |
| *Mdn* | Median |
| *N* | Number of sample |
| ns | Non significant |
| *p* | Significance probability |
| $r_{it}$ | Item-total correlation |
| *z* | Standard score |
| $\beta$ | Beta. Standardized multiple regression coefficient |
| $\delta$ | Theta delta. Error variance and covariance |
| $\eta$ | Eta. Endogenous variable |
| $\lambda$ | Lambda. Factor loading |
| $\xi$ | Xi. Exogenous variable |
| $\phi$ | Phi. Factor variance and covariance |

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# 1 Introduction

Problem-based learning (PBL) has been a major development in medical education since its introduction around 45 years ago. McMaster University initiated the implementation of PBL curriculum in 1969, and within 20 years over 60 medical schools had implemented the method (Neville, 2009). The dissemination of PBL around the world is astonishing. PBL, in a very short time, was endorsed by several national and international organisations. These include the Association of American Medical Colleges, World Federation of Medical Education, the World Health Organisation, World Bank, and the English National Board for Nursing and Midwifery and Health Visiting (Newman, 2003). Despite the widespread use of PBL, the implementations of PBL at that time were without proven evidence of its advantages over conventional approaches (Newman, 2003; Norman & Schmidt, 1992). This condition awed researchers. Norman and Schmidt (1992) even stated that it is ironic that a professional community which prides itself on adherence to the scientific method has been inclined towards PBL despite that proof of its effectiveness was small.

In its basic tenet the implementation of PBL seeks to move away from passive lectures involving monotonous transmission of facts and to move toward active involvement of students in their own learning (Neville & Norman, 2007). As a result of the dissemination of PBL there are various definitions and interpretations of PBL. However, Barrows (1996), the pioneer of PBL dissemination process, describes PBL as an approach to teaching and learning with several characteristics: learning is student-centred; learning occurs in small group; teacher as facilitator; using problems as the stimulus of learning; the problems should reflect the real-world; and new information is acquired through self-directed learning.

In the past three decades there have been vast amounts of research studies conducted which focus on PBL. A keyword search of "problem-based learning" in a database of references and

abstracts (e.g. PubMed) yielded more than eight thousand articles. The output comparison between PBL and non-PBL are still the crown of PBL research. Several reviews on PBL, systematic and non-systematic, have also enriched PBL research.

The output comparison of PBL and non-PBL has been very appealing for researchers. This is because there is a pressure for higher education to provide accountable data on the quality of teaching and learning and its outcomes (Altbach, Reisberg, & Rumbley, 2009; Nusche, 2008). This phenomenon is one consequence of the massification of higher education, which shifted the responsibility for financing higher education from the government to individual students and their families (Altbach, et al., 2009). Additionally, society also demands that higher education put more emphasis on the professional relevance of the study programs and employability while also concerns the benefit of academic learning beyond the labour market (Teichler, 2008).

Even though the amount of PBL research is flourishing, there are several challenges faced by PBL research in general. The most obvious is that there is no clear definition of PBL as a mode of teaching and learning (Hmelo-Silver, 2004; Newman, 2003). Accordingly, there are difficulties in the research operationalisation of PBL. Indeed, there are some specific characteristics proposed by researchers, for example by Barrows (Barrows, 1996). However, in the dissemination of PBL, higher education institutions have various interpretations of these characteristics (Neville, 2009; Newman, 2003). Two universities could declare that they use PBL in their curriculum; however the implementation of PBL between them could be completely different. Based on the vague operationalisation of PBL, it is absolutely improper to compare the output of PBL curriculum among higher education institutions since they might implement different kind of PBL. However, PBL researches rarely take this into consideration.

Regarding the operationalisation of PBL, Newman (2003) used the analogy of fruit for PBL and vegetables for non-PBL approach. Newman stated that it is not only difficult to distinguish between fruit and vegetables but more over it is also difficult to distinguish between different types of fruit (Newman, 2003). He refers to the fact that different interpretations lead to difficulty in distinguishing different PBL implementations.

Furthermore, he added that the view that non-PBL programme is equal to a bad didactic lectures is less relevant nowadays (Newman, 2003).

Apart from the lack of a standardized definition and operationalisation, various modifications of PBL implementation mostly happened because implementing PBL requires a lot of resources (Albanese & Mitchell, 1993; Berkson, 1993; Finucane, Shannon, & McGrath, 2009). One of the major costs is providing infrastructure to support small classes and cover the cost of tutoring personnel. Other costs come from the administrative system change, library stocking, expert availability, and human resources development (e.g. tutor training). The process of change also resulted in immaterial costs such as the stress of change among faculty members and students and the possibility of resistance. Aiming to avoid some of these costs and cope with limited resources, higher education institutions usually implement PBL with some modifications (e.g. PBL in big classes).

However, the implementation of PBL in a less than curriculum-wide mode is more achievable in a broader context (Albanese, 2000). This means teachers implement PBL at the course level or the higher education institution (HEI) implements few components of PBL in their curriculum. For this kind of implementation there is a need to identify PBL components and their effect on particular educational outputs (Hmelo-Silver, 2004; Newman, 2003). So far, however, there has been little research about this topic.

The information on the effectiveness of PBL components is important as the guide for higher education institutions (HEIs) and educators to implement PBL. This information can help higher education institution (HEI) in the following ways:

1. Institutions can choose to implement specific PBL components which align with their educational goals and at the same time match with their limited resources.
2. Educators who want to implement PBL in their courses can choose which PBL components are appropriate to the courses' context and the educational goals.

This information can help higher education institution (HEI) to answer questions such as the following: If we (HEI) want to implement PBL in our institution where should we begin? Which PBL component should we focus on? If our resources are limited, what PBL components should we exclude? If we want to improve certain competencies (e.g. interpersonal competencies) what PBL components should we focus on?

## 1.1 Research Objectives

By reflecting on the previously mentioned contexts, this study was designed to add to the discussion on the effect of PBL on graduates' competencies. The main aim was to identify each of the PBL components which were manifested in the development of a valid and reliable PBL implementation questionnaire. Another focus of this study was to determine the effect of each identified PBL component to specific graduates' competencies. The statistical analysis was based on quantitative data collected in graduate survey conducted for the Faculty of Medicine, Gadjah Mada University, Indonesia.

## 1.2 Improvements from prior researches

Studies investigating the effects of PBL on graduates' competencies are not few (e.g. Mennin, Kalishman, Friedman, Pathak, & Snyder, 1996; Patria, 2011; Schmidt, Vermeulen, & van der Molen, 2006). The present study is not merely intended to replicate the previous studies but moreover it seeks to improve the research method of the previous studies.

The present study seeks to improve the research method of the previous PBL studies by: (1) identifying each of PBL components; (2) using structural equation modelling (SEM) based on latent variables instead of using a variable as proxy of a construct; (3) using confirmatory factor analysis (CFA) to validate the latent structure of the measurement; and (4) using graduate survey data in the evaluation of PBL implementation.

### 1.2.1 Identification of PBL components

Previous PBL studies failed to identify what PBL is and what the difference is between PBL and other approaches. The identification of PBL components in this study provides a better method in researching the effect of PBL on graduates' competencies.

Figure 1.1 illustrates prior approaches used in researching the comparison between PBL and non-PBL. The most common method used is that researchers compare students or graduates data from the same institution but different cohorts (Figure 1.1 A). For example, the first cohort of students uses non-PBL and the second cohort uses PBL. The difference of learning outputs in both groups were then compared (e.g. Cohen-Schotanus, Muijtjens, Schonrock-

Adema, Geertsma, & van der Vleuten, 2008; Hoffman, Hosokawa, Blake, Headrick, & Johnson, 2006; Jones, McArdle, & O'Neill, 2002; Mennin, et al., 1996; Tamblyn, et al., 2005; Watmough, Cherry, & O'Sullivan, 2012).

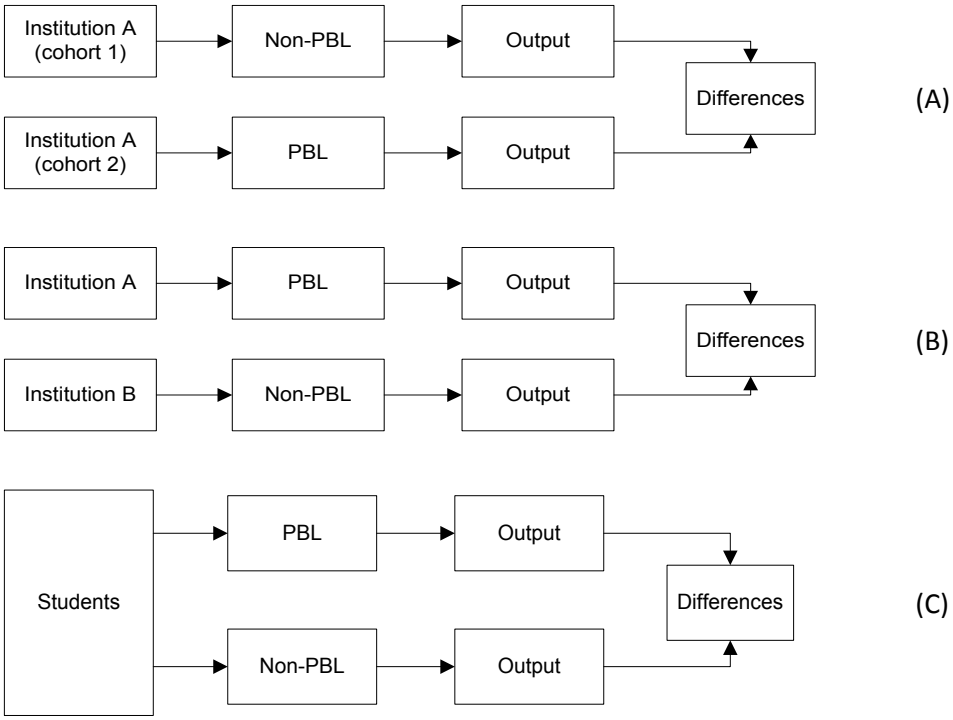



Figure 1.1 Methods in investigating the effects of PBL on educational outputs

Another common method is that researchers compare student or graduate data from different institutions (Figure 1.1 B). For example, researchers choose institution A (which uses PBL) and institution B (non-PBL). Afterwards various set of outputs are compared between those institutions (e.g. Prince, van Eijs, Boshuizen, van der Vleuten, & Scherpbier, 2005; Schmidt, Cohen-Schotanus, & Arends, 2009; Schmidt, et al., 2006; Shin, Haynes, & Johnston, 1993).

A less common method is that researchers use an experimental approach; students voluntarily select in which group they want to study, in the PBL or non-PBL group. Then the differences of educational outputs from both groups were investigated (e.g. Peters, Greenberger-Rosovsky, Crowder, Block, & Moore, 2000).

What could be improved in the methodological approaches used in these previous studies? These approaches based their analysis on the assumption that all PBL implementations are standardized – the institutions implemented the same PBL method. However this is not the

case in reality. PBL is often described as a philosophy, therefore when HEIs state that they use PBL it does not imply that they are implementing the same PBL as another institution (Maudsley, 1999; Newman, 2003). As stated before, HEIs usually modify PBL implementation in order to meet their limited resources. PBL is a kind of teaching and learning method, thus it can be executed poorly. There is good PBL and poor PBL implementation, therefore implementing PBL is not a guarantee that it will produce better educational outcomes than non-PBL. It is largely depend on the quality of the PBL implementation.

Based on the premise that PBL implementation has its own variability, this study proposes a new method to investigate the effect of PBL on competencies. In this study the PBL implementation was evaluated first, afterwards the results of the evaluation process were used to investigate the effects of the PBL implementation on competencies (Figure 1.2).

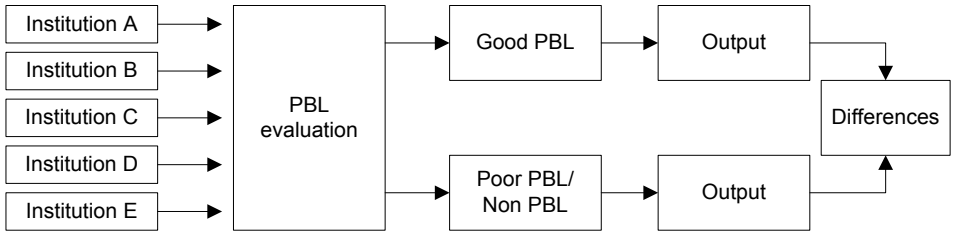



Figure 1.2 Method in investigating the effects of PBL proposed in this study.

This method is loosely based on previous studies on PBL and graduates' competencies. Patria (2011) first evaluated the implementation of PBL then compared the competencies of the graduates. However, the evaluation method was based on only one variable which was methodologically inadequate. In the present study the evaluation method was based on the underlying theory of PBL characteristics, which led to a questionnaire which consisted of 30 indicators representing six factors.

The identification and evaluation of PBL components will create a clearer distinction between PBL and non-PBL. PBL researchers tend to see non-PBL programmes as low-quality instruction method; this view is apparently less relevant now because of the development of teaching and learning methods (Newman, 2003). Not all non-PBL methods are bad because non-PBL could also implement the same components as PBL (e.g. non-PBL but incorporated Student-centred learning method).

### 1.2.2 Using latent variables in the structural models

The present study used the method of structural equation modelling (SEM). Previous studies on the effect of PBL on learning outcomes have used a structural equation modelling approach. In this study, however, the structural models were based on latent variables instead of using a single variable as a proxy of the constructs. Using latent variables in the structural model provide a better measurement than using a single variable as a proxy of a construct (Brown, 2006; DiStefano, Zhu, & Mindrila, 2009; Glass & Maguire, 1966). More about this issue will be discussed in Chapter 3.

### 1.2.3 Using confirmatory factor analysis (CFA)

This study used confirmatory factor analysis (CFA), a type of structural equation modelling which is usually used to assess the latent structure of an instrument. The procedure is suitable to validate the development of the questionnaire. Thus it provides better evidence of validity and reliability. This study assured not only internal consistency of the measurement, as the previous study conducted, but also assured its construct validity by providing the evidence of face validity, convergent validity, and discriminant validity.

### 1.2.4 Using graduate survey data in PBL research

The idea of using graduate survey data in PBL studies is not new (e.g. Cohen-Schotanus, et al., 2008; Hoffman, et al., 2006; Jones, et al., 2002; Patria, 2011; Prince, et al., 2005; Schmidt, et al., 2006). However, prior studies mostly used graduate survey data to investigate the long term effects of PBL on educational outputs. In the present study, graduate survey data is used to explore the unique perspective of the graduates for the purpose of evaluating PBL implementation. Graduates' perspectives in evaluating learning environment are highly essential and cannot be replaced by other sources because graduates personally experience the learning environment.

In the context of relationship between higher education and the world of work, using graduates perspective in researching PBL effectiveness is irreplaceable. Teichler and Schomburg (2013) stated that even though limited by certain bias and validity, graduates'

rating viewed as superior to other measures because it is more specific, more direct to the point of competencies and links between competencies and work task.

## 1.3 Preview of the study

This study is structured by chapter and sub chapter. Chapter 2 reviews the underlying theories of the variables involved in this study. It starts with the overview of Problem-based learning and graduates' competencies. The overview is focused on the underlying theories, recent research and development.

Chapter 3 deals with methods used in this study. It starts with characteristics of the subject, overview of the research setting, preparation of the survey, and field phase process. The following sections of the chapter provide the elaboration of instrument development, i.e. PBL implementation questionnaire and graduates' competencies questionnaire. The data analysis section described the statistical analysis method used in this study and included a brief overview of structural equation modelling and confirmatory factor analysis.

Chapter 4 presents the descriptive statistics of the graduate survey conducted in this study.

The identification of each PBL component is presented in Chapter 5. The chapter depicts the validity and reliability of the instruments used in this study. This was achieved by presenting the results of confirmatory factor analysis. The chapter not only reports the goodness-of-fit of the measurement model but also provides the evidence of construct validity (i.e. convergent and discriminant validity).

Chapter 6 focuses on the effects of each PBL component on graduates' competencies. In addition to the main results of structural model testing of the effects of PBL on graduates' competencies, the chapter also includes a brief overview of the method of investigation of the effects. Comparison of methods to investigate the effects of predictors to outcome (i.e. factor score regression, partial least square path modelling, and structural equation modelling) is briefly discussed with highlighting the reasons for choosing structural equation modelling.

Chapter 7 closes this study with some final remarks, limitations of the study, and possibility for further studies.

# 2 Literature

The present chapter reviews the underlying theories of the variables involved in this study. It starts with an overview of problem-based learning (PBL) with a focus on the role of the teacher, its rationale, and its research development. The following sections reviewed the literature on graduates' competencies. In addition to the definition of competencies, the literature review also focuses on the discussion of graduates' competencies in PBL research.

## 2.1 Problem based learning

In 1969 Mc Master University pioneered the first implementation of PBL in the new medical school, the Faculty of Health Sciences (Neville & Norman, 2007). The first class of 1969 had 20 students but rapidly increased to 100 students over the following few years. In 2004 it had increased to 140 students (Neville & Norman, 2007). Within 20 years, over 60 medical schools around the world have implemented PBL as a whole system or as part of it (Neville, 2009). The implementation of PBL has been endorsed also by various national and international organisations including the Association of American Medical Colleges, the World Federation of Medical Education, the World Health Organization, the World Bank, and the English National Board for Nursing Midwifery and Health Visiting (Newman, 2003). Researcher has labelled PBL as a revolution in medical education which had a big impact on the development of medical education.

As a consequence of the vast dissemination of PBL, numerous medical schools have implemented PBL in their courses. Barrows (1996) observed that many institutions, especially with long traditions, want to create PBL variation that is suitable to their rigor and excellence. The modification of PBL resulted in a wide variety of methods that lessens the

precision of the term PBL (Barrows, 1996). This condition also affected the definition of PBL. There are various definitions of PBL found in PBL studies and literatures.

Savery (2006) defines PBL as an instructional (and curricular) learner-centred approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem. He further pointed out that the selection of problems and guidance of the tutor is critical to the success of the approach.

Vernon and Blake (1993) defines PBL as a method of learning and teaching that emphasizes: (1) the study of clinical cases, either real or hypothetical, (2) small discussion groups, (3) collaborative independent study, (4) hypothetico-deductive reasoning, and (5) a style of faculty direction that concentrates on the group process rather than imparting information.

According to Gijselaers (1996) PBL derives from active learning theory in which the learner actively constructs knowledge. Therefore, the transmission of subject-matter through direct instruction (i.e. lecturing) is only of limited use and it should focus on helping students acquire self-directed learning skills.

Despite the many variation of PBL definitions there are several characteristics that differentiate PBL from other methods. Barrows (1996) identifies the characteristics of PBL developed in McMaster University. Those characteristics are: learning is student-centred; learning occurs in small groups; teacher as facilitator; using problems as the stimulus of learning; the problems should reflect the real-world; and new information is acquired through self-directed learning (Barrows, 1996).

In Maastricht University, the process of PBL has been divided into seven discrete steps, known as the Seven Jump (David & Patel, 1995). Table 2.1 depicts the process of Seven Jump tutorial process.

At the first meeting, students are given a real-world problem, often called a scenario. After reading the scenario, students should clarify terms and concepts in the scenario. The next step is to define the problem and concepts to be explained. Students must discuss and explain to each other all the phenomena present in the scenario. In this part, students must recall their prior knowledge as much as they can to explain the problems in the scenario. Students' prior knowledge in this phase is insufficient to understand and solve the problem.

Because of their insufficient prior knowledge, questions and dilemmas will come up during the discussion phase.

Table 2.1
The Seven Jump tutorial process

| |
|---|
| 1. Clarify unfamiliar terms and concepts in the problem which are unknown to you. |
| 2. Define the problem, that is list the phenomena to be explained. |
| 3. Explain the problem; try to produce as many different explanations for the phenomena as you can think of. Use prior knowledge and common sense. |
| 4. Arrange the explanations proposed; try to produce a coherent description of the processes that you think underlie the phenomena. |
| 5. Formulate learning goals. |
| 6. Attempt to fill the gaps in your knowledge through individual study. |
| 7. Share your findings with your group and try to integrate the knowledge acquired into a comprehensive explanation for the phenomena. Check whether you know enough. |

*Note*. Source: David and Patel, 1995 (p. 359).

During the discussion phase, students have to define the keywords and nuances stated in the problem. Students also have to analyse the problem and list the possible solutions to the problem. In the last session of the first meeting, students should jointly formulate learning objectives or learning goals.

Learning objectives or goals consist of unexplained terms or a concept list which will be their guide in the learning process. With the learning objectives stated clearly, students will collect information by themselves (or in a group). It could be from library literature, internet research, laboratory work, or from discussion with experts. It is obvious that problem-based learning should be supported by a well-stocked library. In this stage students are practically studying by themselves. However, their learning process is not completely loose. It is already guided by learning objectives. After some period of time, the students will meet again in class and synthesise their findings based on the learning objectives. In this step, students must present new information to each other and cover all learning objectives. Besides sharing their findings with the group, students should also try to integrate the acquired knowledge into a comprehensive explanation for the phenomena.

While a variety of definitions of PBL have been suggested, this study will use the definition suggested by Barrows (1996) that PBL is a teaching and learning method which has the following characteristics: learning is student-centred; learning occurs in small group; teacher

as facilitator; using problems as the stimulus of learning; the problems should reflect the real-world; and new information is acquired through self-directed learning.

### 2.1.1 Role of teacher in PBL

The active learning component in PBL which is reflected in the student-centred learning, teacher as facilitator, and self-directed learning process requires the teacher (often referred as tutor) to change their role.

Barrows and Tamblyn (1980) suggested that a teacher in the PBL process should suppress the urge to tell students what they should do in evaluating a problem properly. The teacher also should suppress the urge to give the students the facts, principles, and concepts they need to understand the challenge in the subject-matter or related basic science involved (Barrows & Tamblyn, 1980). This, however, does not mean that teacher is inactive in the process of learning. Barrows and Tamblyn (1980) further explained that the teacher should allow students to discover their own mistakes and at the same time encourage the students to apply sound reasoning skills and use effective study skills to acquire the knowledge appropriate to the learning objectives.

Mayo et al. (1995) suggested that the tutor must possess two distinct sets of skills. The first set is PBL procedural skills (e.g. how to choose a course of action, how to plan step-by-step tutorial guidance through the PBL process within a small-group setting). The tutor should involve all students in the discussion, keep the discussion focused on the theme, give students time to think before answering, and keep the group on track.

The second set of tutor skills relates to the skills for fostering the clinical reasoning process in students. The tutor must master inquiry ability to prepare students to think critically and make informed decisions in the context of real patient case. To achieve this, the tutor should rely heavily on the use of open-ended questions (Mayo, et al., 1995).

There has been a discussion about the characteristics of the type of tutor who best facilitates the learning process. It was previously known that content-expert tutors would be overly tempted to lecture to the students in a tutorial, thereby detracting the students' opportunity to bring any prior knowledge or understanding that they might have to tackle the biomedical problems facing them in the tutorial (Neville & Norman, 2007).

A study by Silver and Wilkerson (1991) pointed out the negative effects of tutors with expertise in the subject matter. Tutors with expertise tended to take a more directive role in tutorials, i.e. they spoke more often and for longer periods, provided more direct answers to the students' questions and suggested more of the topics for discussion. Tutor-to-student discussion was more prevalent than student-to-tutor discussion. These effects endanger the goal of PBL, which is to develop students' skills in active, self-directed learning.

However, studies also asserted that tutors' subject-matter expertise has a significant effect on the tutorial process. A study about the relationship between students and tutors concluded that expertise on the subject matter is not essential, but it certainly helps as content experts are better equipped to decide when the discussion becomes incoherent and are able to ask questions that stimulate discussion (De Volder, 1982).

Schmidt and Moust (1995) pointed out that an effective tutor merges two different perspectives. One perspective emphasises the personal qualities of the tutor: his or her ability to communicate with students in an informal way, coupled with an empathic attitude that enables the tutor to encourage student learning by creating an atmosphere in which open exchange of ideas is supported. The second perspective stresses the tutor's subject-matter knowledge as a determinant of learning.

Another study by Eagle, Harasym and Mandin (1992) pointed out that it is important for tutors to be well informed about cases and case objectives and to be well versed in the PBL tutoring process. A similar study by Davis et al. (1992) indicated that students led by the content experts had higher levels of satisfaction and higher examination scores.

### 2.1.2 Rational and theoretical foundation of PBL

Barrows (2000), one of the PBL pioneers, explained that he and his colleagues on the original McMaster PBL team had no background in educational psychology or cognitive science. They just thought that learning in small groups through the use of clinical problems would make medical education more interesting and relevant for their students. Barrows observed that medical students seems bored and dissatisfied with their education and considered the basic science years as a difficult and irrelevant hurdle in medical education. There was also

too much emphasis on memorization of facts and students seemed to forget what they were taught later in their clinical years (Barrows, 2000).

Nevertheless, there are some aspects of cognitive psychology, particularly psychology of memory, which can explain the theoretical bases of PBL. There are three aspects of memory relevant to the assessment of the effects of PBL: (1) activation of prior knowledge facilitates the subsequent processing of new information; (2) elaboration of knowledge at the time of learning enhances subsequent retrieval; and (3) matching context facilitates recall (Norman & Schmidt, 1992).

Prior knowledge about the subject determines what people can learn about that subject. With this in mind, the learning context must be such that it activates students' prior knowledge. The problems in the tutorial process act as a trigger for activating students' prior knowledge regarding the discussed content. The small group discussion is also a good condition to foster the activation of students' relevant prior knowledge.

Elaboration of the knowledge will enhance students' memory attainment and the ability to use the knowledge. Elaboration can be in the form of discussion, note-taking, answering questions, or using the knowledge to understand problem. A PBL tutorial is highly coloured by these activities.

The matching context between learning processes and retrieval context will improve the memory recall. PBL provides an appropriate context for learning. Through the scenario, students will learn the knowledge in the context of the clinical problem. In the real-world, when facing the same problem, they will easily recall what they have learned.

According to Barrows and Tamblyn (1980), there are three main objectives of PBL. The primary goal is to foster clinical reasoning or problem-solving competencies in students. Barrows believes that through continuous exposure to real-life problems with solution strategies, students will acquire the skills of evaluating patient problems, and making decisions about appropriate actions to treat the problem. The second objective is to enhance acquisition, retention, and use of knowledge. Learning new knowledge in the context of a problem may foster its retrievability when needed to solve similar problems. Furthermore, PBL also may narrow the gap between basic and clinical science, since they have learned

many of the basic science concepts while solving simulated clinical problems. Basic science and clinical science are taught separately in the conventional curriculum.

To enhance self-directed learning is the third objective of PBL. Barrows and Tamblyn (1980) determined that students should be able to extend their knowledge base to keep up-to-date in the field of medicine. In the future students should have the ability to formulate the learning needs and to determine the best resources to fulfil the needs. Student should be able to use these resources in the proper way. Barrows observed that most doctors do not know how to use the available resources (e.g. library) effectively (Barrows & Tamblyn, 1980)

In his paper on connecting problem-based practices with educational theory, Gijselaers (1996) asserted that PBL derives from the theory that learning is a process in which the learner actively constructs knowledge. He further added that modern cognitive psychology suggest that learning results from the learner's actions, therefore instruction plays a role only to the extent that it enables and fosters constructive activities. This implies that transmission of learning content through direct instruction (e.g. lecturing) should be limited. The teacher should focus on helping students acquire self-directed learning skills (Gijselaers, 1996).

Based on Glaser's (1991) paper on the relationship between learning and cognition and educational practice, Gijselaers (1996) suggested three principles from cognitive psychology that could be the theoretical basis for improving instruction in general and PBL in particular. Those principles are: (1) learning is a constructive and not a receptive process, (2) metacognition (or knowing about knowing) affects learning, and (3) social and contextual factors influence learning.

#### 2.1.2.1 Learning is a constructive and not receptive process

Modern cognitive psychology asserts that one of the most important features of memory is its associative structure (Bruer, 1993). This is a different perspective than decades ago when education was dominated by the view that students were seen as empty bucket that needed to be filled with information through repetition and rehearsal (Bruer, 1993). Gijselaers (1996) added that knowledge is structured in networks of related concepts, referred to as semantic networks. New information acquired by learner is integrated in the existing networks. Gijselaers (1996) further added that semantic networks represent a way to store the information and how information is interpreted and recalled.

For example, while reading a new text, one needs background knowledge to construct and retain the information in the text. When background knowledge is not activated or not available, it is difficult to remember the information in the text (Bruer, 1993). To accentuate this, Bruer (1993) cited an experiment conducted by Bransford and Johnson (1972). In Bransford and Johnson's (1972) experiment the respondents were asked to read the following passage once and then write down as much as one can remember:

> The procedure is actually quite simple. First you arrange things into different groups. Of course, one pile may be sufficient depending on how much there is to do. If you have to go somewhere else, due to lack of facilities, that is the next step, otherwise you are pretty well set. It is important not to overdo things. That is, it is better to do a few things at once than too many. (Gijselaers, 1996) p. 14.

Bruer (1993) commented that despite that the words are easily to understand, respondents had difficulties in retrieving the information of the passage they have just read. If the title of the passage, "Washing Clothes" had been given first, the text would have been easy to understand and remember. The title "Washing Clothes" activates background knowledge related to the information in the text. Consequently, as concluded by Gijselaers (1996), in the education process, attention should be directed to the activation of students' existing knowledge to provide a framework for learning process. The activation of existing knowledge to facilitate processing of new information is a basic requirement of learning.

#### 2.1.2.2 Metacognition affects learning

The second aspect of learning is that learning is more effective when students posses self monitoring skills, referred as metacognition (Bruer, 1993). Gijselaers (1996) articulates metacognition as an essential element of skilled learning which contains: goal-setting (what am I going to do), strategy selection (how am I doing it?), and goal evaluation (did it work?). Gijselaers (1996) further added that successful problem solving is not only dependent on the possession of an extensive body of knowledge, but also on the use of problem-solving methods to accomplish goals. Glaser (1991), who also calls metacognition second-order knowing, mentions that metacognition is the ability that enables individuals to reflect upon and control their own activities. In the course of learning it is applicable in the situations such as: knowing when to apply some procedure or rule, predicting the correctness or

outcomes of a performance, planning ahead, and efficiently apportioning cognitive resources and time (Glaser, 1991). Metacognition is teachable. Bruning, Schraw, and Ronning (cited in Gijselaers (1996)) discuss several teaching strategies to promote metacognition development. Those strategies include: encourage students to engage in deep processing, focusing on understanding rather than surface memory; promote elaboration of new ideas; and help students become more metacognitively aware by demonstrating the kinds of questions they can ask themselves during the problem-solving action.

#### 2.1.2.3 Social and contextual factors influence learning

The third principle of cognition that has implications for educational practice is the influence of the context or situation in which learning occurs. Cognitive activity that surrounds the educational setting is inseparable from its cultural environment (Glaser, 1991). Glaser (1991) further added that education institutions should interpret the culture, channel learning, and define the kinds of problems learners solve and the tools available to solve them.

Referring to this social context, Gijselaers (1996) mentioned that it is important for students to experience learning in the context of real-world problems or professional practice. Students will see how experts use subject knowledge and metacognitive skills for solving a problem. Linking the content with the context of learning facilitates the retrieval of knowledge (Norman & Schmidt, 1992).

Social factors also influence individual learning. Glaser (1991) argues that working in a group can serve several roles. First, it extends the available knowledge and thereby supports alternative problem approaches and inference. Second, it multiplies the focus of self-regulatory activity by providing various trigger for cognitive dissatisfaction.

Glasser (1991) added that in a group setting the learner is exposed to alternative points of view that challenge his or her initial understanding. This kind of elaboration enhances the memory of the subject matter and the ability to use the knowledge (Norman & Schmidt, 1992).

PBL is regarded as an approach that meets these characteristics. In all steps of the PBL process students experience the fundamental principles of cognition that support the educational process as suggested by Glaser (1991) and Gijselaers (1996).

In the first session of a PBL tutorial students will be given a problem (see Table 2.1 for the complete steps of PBL tutorial). Students then work around the problem to developed learning goals at the end. Students try to clarify unfamiliar terms and concepts in the problem which are unknown to them.

This process is coloured by the first and second principle. The first principle is reflected in the activation of prior knowledge before the learning process started. This will enhance the associative structure of the learning content (Gijselaers, 1996).

The second principle is reflected in the process of deciding the learning goals. Facing the problem in the tutorial process, students have to define the problem and list the phenomena to be explained. They try to explain the problem; try to produce as many different explanations for the problem they face. They have to arrange a tentative explanation to produce a coherent description of the process that underlies the phenomena. Afterwards they have to conduct individual study based on the learning goals. In this process students learn metacognition skills; they learn how to select the strategy to achieve the learning goals. They have to evaluate whether their approach is working or not. The discussion process during the tutorial is also a form of problem elaboration which encourages the metacognition development.

The third principle, social and contextual factor, is reflected in the whole process of PBL tutorial. The use of real-world problem as the trigger of learning provides the necessary relation to students' future world profession as physicians. A real-world problem is an ill-structured problem. Ill-structured here means that there is more than one answer to the problem. Ill-structured problems stimulate students to generate multiple hypotheses about the cause and the possible solution. Besides providing a medical world context, ill-structured problems also motivate the students. A well-structured problem make students less motivated and less invested in the development of the solution (Savery, 2006).

The social context in the third principle is reflected in the use of small-group activity in PBL process. The small-group environment stimulates a more intense discussion in PBL process. The size of the group enables all students to have the same opportunity to share in the discussion and makes it impossible for the students to be passive. Students easily collaborate in a small group. As mentioned before, the small group process also promotes elaboration of

knowledge (e.g. discussion, raising opinion, challenging their peers' opinions, note-taking, answering questions, and using knowledge to understand a problem) which enhances the knowledge retrieval (Norman & Schmidt, 1992).

#### 2.1.2.4 Critiques on PBL theoretical foundation

There has been also a critical discussion about the theoretical foundation of PBL and unguided learning in general. Kirschner and colleagues (2006) described unguided or minimally guided learning as a learning context in which "learners, rather than being presented with essential information, must discover or construct essential information" (p. 1). As for direct guidance, they described it as "providing information that fully explains the concepts and procedures that students are required to learn as well as learning strategy support that is compatible with human cognitive architecture" (p. 1). Kirschner, Sweller, and Clark (2006) have categorized PBL (together with discovery learning, inquiry learning, experimental learning, and constructivist learning) as minimal guidance approach. Kirschner and colleagues had viewed long-term memory as the central, dominant structure of human cognition. The aim of all instruction is to alter long-term memory. Therefore any instructional recommendation that does not or cannot specify what has been changed in long-term memory, or does not increase the efficiency with which relevant information stored in our retrieved from long-term memory, is likely to be ineffective (Kirschner, Sweller, and Clark, 2006).

Kirschner and colleagues' view on the effectiveness of PBL has been challenged by several researchers. Hmelo-Silver, Duncan, and Chinn (2006) responded to Kirschner and colleagues' paper by pointing out some arguments. Hmelo-Silver and colleagues (2006) agree with Kirschner et al. (2006) that there is little evidence to suggest that unguided and experientially-based approaches foster learning. However, Hmelo-Silver et al. (2006) further pointed out that PBL is not a discovery approach and is not an example of minimally guided instruction. Rather, PBL provides scaffolding and guidance to facilitate student learning.

Kirschner et al. (2006) mostly based their conclusion on the results of meta-analysis and systematical reviews on comparison of PBL with conventional medical school instruction (i.e. Albanese & Mitchell, 1993; Berkson, 1993; Colliver, 2000). Kirschner et al. (2006) concluded that the results of those studies, even though there are some advantages of PBL, still favour

the conventional approach and that the PBL approach is ineffective and inefficient. However, Kirschner et al. (2006) excluded another meta-analysis conducted by Vernon and Blake (1993) which was regarded as important meta-analysis on PBL.

The next section will review more on meta-analysis and systematical review studies on the comparison between PBL and conventional method.

### 2.1.3 The development of research in PBL and its debates

In the past four decades, a considerable amount of literature has been published on PBL. A keyword search of "PBL" or "problem-based learning" in a journal database such as ISI Web of Knowledge™ or PubMed yields more than five thousands articles. Obviously it is impossible to discuss all of these articles in the present study. In this study, the overview of development of research in PBL will be limited to the literature of the effectiveness of PBL on graduates' competencies. The review in this section is focussed on studies which implemented systematic review and meta-analysis studies.

The literature on systematic review and meta-analysis study on PBL started in 1993 with the dissemination of three studies (i.e. Albanese & Mitchell, 1993; Berkson, 1993; Vernon & Blake, 1993). Albanese and Mitchell's (1993) review is perhaps the most prominent one in PBL literature. They conducted meta-analysis on PBL literature from 1972 to 1992. The results asserted that compared with the conventional method, PBL is more nurturing and enjoyable. PBL graduates perform as well and sometimes better on clinical examinations and faculty evaluations. However, PBL students score lower on basic science examinations and viewed themselves as less well prepared in basic science than their colleagues in the conventional method. PBL graduates tended to engage in backward reasoning rather than forward reasoning and there are gaps in their cognitive knowledge base that could affect practice outcomes.

Similar to Albanese and Mitchell's (1993) study, Vernon and Blake (1993) synthesized all available PBL research from 1970 to 1992 that compared PBL with conventional methods. The study summarized 22 studies from 14 institutions. They concluded that evidence from the studies included in the meta-analysis supports the superiority of PBL over a more conventional method. Students of PBL and conventional methods did not differ on tests of

factual knowledge and tests of clinical knowledge. However, PBL was found significantly superior in students' clinical performance. Students from the conventional method indeed performed better on the National Board of Medical Examiners (NBME) Part I examination. Nevertheless, Vernon and Blake (1993) added that NBME I data showed significant overall heterogeneity and significant differences among programs, which cast doubt on the generality of the findings across programs.

Berkson (1993) also conducted a systematic review of the effectiveness of PBL. The study compared the effectiveness of PBL with conventional methods in six topics: problem solving, imparting knowledge, motivation to learn medical science, promoting self-directed learning skills, student and faculty satisfaction, and financial costs. Berkson (1993) concluded that "Twenty-five years of experimentation with educational process has not produced a distinctive, more competent physician" (p. S85). Additionally, PBL was concluded to be stressful for both student and faculty and unrealistically costly (Berkson, 1993).

A more recent review by Colliver (2000) pointed out similar finding. He reviewed PBL studies from 1992 to 1998 (total of 29 studies) and concluded that there was no convincing evidence that PBL improves students knowledge base and clinical performance. Colliver (2000) added that the evidence was not as expected considering the extensive resources required for operation of PBL. Nevertheless, Colliver (2000) acknowledged that PBL provided a more challenging, motivating, and enjoyable approach to medical education.

Another systematic review from the same year was conducted by Nandi et al. (2000) which summarized PBL studies from 1980 to 1999. Nandi and colleagues' (2000) reported that students who use PBL showed better interpersonal skills and psychosocial knowledge, as well as better attitude towards patients. Students of the PBL curriculum found learning to be *more stimulating and more humane* and *engaging, difficult, and useful*, whereas students of the conventional curriculum found learning to be *non-relevant, passive, and boring*. However, students using the conventional model performed better in basic science examinations. Generally there is no convincing evidence of improved learning using the PBL method.

A more recent systematic review on PBL literature was conducted by Newman (2003). Newman included 12 studies of PBL effectiveness published during 1985 to 1999. The results

suggested that there was limited high quality evidence that can support the effectiveness of different kinds of PBL in different contexts, in different students groups (Newman, 2003).

The previously mentioned meta-analysis and systematic reviews provided rather grim results on the evidence of PBL effectiveness compared to conventional methods. This becomes a challenge for researchers who favour PBL. Researchers in favour of PBL tried to counter the arguments to the idea that the PBL method is less effective than the conventional one. Researchers also tried to evaluate and improve the methodology in PBL studies. Albanese (2000) for example, raised criticism of PBL research methodology, especially of the criteria used in meta-analysis studies. Albanese (2000) stated that the expectation of effect-size value in meta-analysis study (such as used in Colliver (2000)) is too excessive. Colliver's (2000) study expected an effect size of .8 - 1.0. Albanese (2000) argued that this effect size expectation is too high because an effect size of 1.0 would move students from the 50th percentile to the 80th; which would be an impressive degree of change. Albanese (2000) also pointed out that students were groomed and selected to succeed in a conventional curriculum, therefore to expect them to do better in the PBL method was an unreasonable expectation.

Norman and Schmidt (2000) pointed out that they agreed with Collivers's (2000) conclusion that the PBL method did not result in dramatic difference in cognitive process. However, Norman and Schmidt (2000) were against Collivers's (2000) conclusion that the lack of findings regarding PBL effectiveness is due to the inadequacy of PBL theory. Norman and Schmidt (2000) asserted that the small effect in PBL effectiveness research is:

> from the futility of conducting research on interventions which, like PBL, are inadequately grounded in theory, in real environments, which are so complex and multifactorial, with so many unseen interacting forces, using outcomes so distant from the learning setting, that any predicted effects would inevitably be diffused by myriad unexplained variables. (p. 722)

Norman and Schmidt (2000) further added that the fact that any significant effects have been observed is an evidence of the effectiveness of PBL.

There are also criticisms to meta-analysis and systematic review studies in general. There is often a lack of clarity of the selection and inclusion criteria used to select the studies included

in the study (Wolf, 1993). There is also apprehension that meta-analysis study reduces a rich literature to a single number, there by losing much of the richness and information provided in the original study (Distlehorst, 1994; Wolf, 1993).

The more recent PBL systematic review and meta-analysis tried to improve the methods used in their study. Dochy and colleagues' (2003) meta-analysis, besides addressing PBL effects on knowledge and skills, was also concerned about potential moderators of PBL effects. The result of the study asserted that there is a positive effect from PBL on students' skills. However, there is a negative effect of PBL on students' knowledge base, compared with the knowledge of students in conventional learning environment. Nevertheless, Dochy et al. (2003) further added that the negative result was due to two outlier studies. When the outliers were excluded, there was no difference in the knowledge of PBL students and their conventional counterparts.

Dochy et al. (2003) identified and tested three moderators of the effect of PBL: methodological factors (research design and scope of implementation), expertise-level of students, retention period and type of assessment method. The moderator analysis indicated that the differences of knowledge arising in the first and second year of schooling disappear later on. This is due to the fact that conventional curriculum tends to be characterized by a two-year basic science while in PBL students are immediately compelled to apply their knowledge to the problems that arise. Additionally, the moderator analysis indicated that students in PBL have slightly less knowledge (they know less facts), but their knowledge has been elaborated more and thus have better retention.

Gijbels and colleagues' (2005) meta-analysis concentrated on examining the effects of PBL based on the method of assessment used in the studies. Gijbels and colleagues (2005) used Sugrue's model on the cognitive components of problem solving to classify the method of assessment. It yielded three categories of analysis: understanding of concepts, understanding of the principles that link concepts, and linking of concepts and principles to conditions and procedures for application. The analysis composed of only to 40 PBL studies because the meta-analysis only included studies with a quasi-experiment method. Gijbels et al. (2005) also expanded the literature search beyond medical education. Nonetheless, the study only discovered one study in the field of economics that matched with their inclusion criteria.

The result of Gijbels et al. (2005) study concluded that the effect of PBL differs depending on the level of the knowledge structure being measured. PBL had the most positive effects when the focal constructs being assessed were at the level of understanding the principles that link concepts – the second category of analysis (Gijbels, et al., 2005).

Gijbels et al. (2005) study also answered the question of why prior studies reported negative effects of PBL when assessing the understanding concept. Gijbels et al. (2005) asserted that when weighted average effect size is taken into account, PBL has small positive effect size. This means that when understanding of concepts is the subject of the assessment, students in PBL perform at least as well as their counterparts in conventional learning environment.

Koh and colleagues (2008) conducted a systematic review on PBL effects, especially on physicians' competencies after graduation. Koh et al. (2008) identified 2675 studies from 1967 until 2006. The selection process led to 102 studies and in the final review included only 12 studies. The evaluation of competencies used graduates' self-assessment and observed assessment from validated tests, administrative databases, supervisors and nurses. The self-assessment data depicted that eight competencies had a strong level of evidence in support of PBL: continuity of care, teamwork, appreciation of social and emotional aspects of health care, appreciation of legal and ethical aspects of health care, attitudes toward personal health and well-being, coping with uncertainty, use of computers or information resources and understanding evidence-based medicine.

The observed assessment data showed that seven competencies had a strong level of evidence in support of PBL: diagnostic skills or accuracy, communication skills, appreciation of cultural aspects of health care, appreciation of legal and ethical aspects of health care, responsibility or reliability, coping with uncertainty, and self- or peer appraisal (Koh, et al., 2008).

From both self and observed assessment only four competencies had moderate to strong evidence in support of PBL: coping with uncertainty, appreciation of legal and ethical aspect of health care, communication skills, and self-directed continuing learning (Koh, et al., 2008).

Walker and Leary's (2009) included 82 PBL studies in their meta-analysis study with a total of 201 study outputs. Since the implementation of PBL is no longer dominated by medicine fields, Walker and Leary (2009) included also 47 PBL studies outside the fields of medical

education and health. The result of the analysis asserted 68 positive outcomes and only 21 negative which are statistically significant in favour of PBL.

Walker and Leary (2009) further reported that most of the studies selected in the analysis were from medical education; however the results were not promising. The most promising results of PBL and conventional method comparison were found in the field of teacher education. This was in contrast with the results in engineering and science which showed that PBL and conventional methods yielded identical outcomes.

Smits and colleagues' (2002) study reviewed only controlled evaluation studies of the effectiveness of PBL. The study concluded that there is moderate evidence that PBL leads to higher graduates' satisfaction. However, there is no consistent evidence that PBL in continuing medical education is superior to other methods in increasing physician's knowledge and performance.

The aforementioned meta-analysis and systematic review studies indeed asserted various results and are inconclusive regarding the effects of PBL. Regarding the debates whether PBL is more effective or not compared to the non-PBL approach, there is a discussion that the question of the effectiveness of PBL should be moved from whether PBL is working or not. Instead, it should be directed to questions such as: under what circumstances does PBL work; what are the kinds of outputs for which it is effective; what kinds of valued practices does it promote; and what kinds of support and scaffolding are needed for different populations and learning goals (Hmelo-Silver, et al., 2006).

As previously mentioned in the introductory chapter, the present study is not merely intended to replicate prior studies but also proposes an improvement of the PBL research method. PBL's inconsistent and inconclusive effects might be explained by the absence of PBL implementation evaluation. All the reviewed studies based their analysis on the assumption that PBL implementation is standardized – all institutions implemented the same PBL method. The reality is that institutions often modify PBL implementation in order to meet the institution's limited resources. PBL, as another method of teaching and learning, can be executed poorly which also leads to poor educational outputs. Therefore in order to improve the research method, PBL implementation should be first evaluated before comparing PBL and non-PBL outcomes (see again explanation of Figure 1.2). Furthermore, to

improve the research method of the previous studies, this study also used a structural equation modelling approach based on latent variables and used confirmatory factor analysis to validate the latent structure of the measurement.

## 2.2 Competencies

Since the 1990s there has been increasing interest in research of the relationship between study and the requirements of the world of work (Teichler & Schomburg, 2013). One of the reasons for this is the increase of evaluation activities in higher education. As stated previously in the introduction chapter, massification of higher education has shifted the responsibility for financing higher education from the government to individual students and their families (Altbach, et al., 2009). This leads to the pressure from society on higher education to provide accountable data on the quality of teaching and learning and its outputs (Altbach, et al., 2009; Nusche, 2008). Additionally, society also demands that higher education put more emphasis on the professional relevance of the study programs and employability while not neglecting the benefit of academic learning beyond the labour market (Teichler, 2008). This includes the demand of assessment not only to the knowledge acquisition but also the abilities of the students which relates to the use of term such as competencies (Teichler & Schomburg, 2013).

The term "competence" or "competency", or in plural form competences or competencies, has many different meanings, definitions and even spellings. Competence(s) generally refers to functional areas or the ability to perform activities within an occupation to prescribe standard, while competency or competencies refers to behavioural area which is causally related to effective or superior performance (Deist & Winterton, 2005; Horton, 2002). Furthermore Horton (2002) added that competency/competencies focus on the inputs that help to achieve successful performance in a job; while competence(s) focus on the demonstrated outcomes of competence. Nevertheless, the usage of both terms is inconsistent (Deist & Winterton, 2005). For consistency purpose this study used the term competencies throughout the chapters. Some of the definitions that can be found in the abundance literature of competencies:

- collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies (Prahalad & Hamel, 1990)
- an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation (Spencer & Spencer., 1993).
- an underlying characteristics of an individual, which is causally related to effective or superior performance in a job (Boyatzis in Adams, 1997)
- a set of learning outcomes (skills or competencies) which each individual should acquire during or demonstrate at the end of a period of learning (Holmes & Hooper, 2000)
- the skills, knowledge, experience, attributes and behaviour that an individual needs to perform a job effectively (Horton, 2002)
- the ability acquired through learning and socialisation, to act successfully (Kellermann, 2007).
- knowledge, skills, and attitude that can be used successfully in different working situations and professional contexts (Vaatstra & De Vries, 2007)

Even though McClelland is not the first researcher who uses the term competencies, he was responsible for pioneering its dissemination. In his paper entitled *Testing for competence rather than for "Intelligence"*, McClelland criticized the use of intelligence and aptitude test for predicting the success of students and employees (McClelland, 1973). McClelland argued that the evidence for the validity of intelligence and aptitude tests are weak and it is not suitable for predicting 'success in life'. He further suggested assessing competencies involved in clusters of life outcomes.

Even though McClelland suggested the development of competencies assessment based on criterion sampling on job analysis, he admitted that the approach will not applicable since there will be dozens of tests for different occupations. He suggested instead the assessment of competencies "that are more generally useful in clusters of life outcomes, including not only occupational outcomes but social ones as well, such as leadership, interpersonal skills, etc" (McClelland, 1973, p. 9). Example of competencies, according to McClelland, include: communication skills, patience, moderate goal setting, and ego development.

McClelland's view is naturally more based on his expertise – industrial and organisational psychology. McClelland's view tends to discuss competencies in the context of employment processes such as selection process, recruitment, and job appraisal. The discussion of competencies in educational setting, as mentioned earlier, is related more to how higher education can develop the competencies that are required by the world of work. The discussion was coloured by the concern that higher education become inferior partner of the world of work because they have to supply the demands of employers. However, as mentioned by Teichler (Teichler & Schomburg, 2013), the emphasis on the development of competencies should not viewed based on the belief that higher education is inferior to the world of work; rather it should be based on the reference to the fact that the utilisation of competencies in the world of work is important for the individual and society. Therefore, based on this view it is natural that higher education strives to improve the students' competencies to be able to function in the society and excel in the world of work.

The discussion of competencies in higher education yields various topics such as employability, key qualification, and over qualification. These terms are related with the development of competencies in higher education and the requirement in the world of work. The apprehension that higher education could not provide the necessary competencies required by the world of work promotes evaluation activities. The focus of the evaluation inclined to the measurement of the core activities of higher education (i.e. teaching, learning and research) (Teichler & Schomburg, 2013). Research in PBL as related to the development of graduates' competencies is one example of the movement towards evaluation in higher education. Research on the effectiveness of PBL in comparison to non-PBL was propelled by the concern such as whether PBL could develop students' competencies better than non-PBL.

### 2.2.1 Graduates' competencies in PBL studies

This section reviews the set of competencies used in PBL research. Competencies research in PBL attracted researchers because there is a need to know the effectiveness of PBL. The main focus is mostly on the comparison of competencies between PBL and non-PBL.

Mennin and colleagues (1996) had surveyed graduates in practice from the University of Mexico School of Medicine. The study compared two cohorts, the PBL and non-PBL, of

graduates in practice patterns, learning behaviours, and satisfaction with the professional medicine. In addition the study also included competencies part in which graduates were asked about how well the undergraduate medical curriculum had prepared them. The scale was using a Likert-type scale with rating ranging from 1 "not prepared" to 7 "well prepared".

The competencies list in Mennin and colleagues (1996) included: clinical reasoning, coping with uncertainty, diagnostic skills, doctor-patient relationship, follow-up care, health economics, history-taking skills, interviewing skills, continuing education, patient education, physical examination skills, preventive care issues, service for medically underserved areas, self-assessment, teamwork, therapeutic management, and overall preparation for medical practice. The result asserted that compared with the conventional-track, PBL graduates reported being better prepared with significant differences in 12 of the 17 competencies. There were no significant differences between the two groups of graduates regarding: health economics, history-taking skills, interviewing skills, physical examination skills, and therapeutic management.

Jones and colleagues (2002) conducted a similar study with two cohorts of medical school graduates of University of Manchester, UK. The main focus of the study was to explore whether the new curriculum with a PBL method had produced any difference with the previous, more conventional curriculum. Graduates were surveyed three months into their first pre-registration house officer placement. Besides the graduates, Jones and colleagues' (2002) study also surveyed the educational supervisors who supervise the graduates in their pre-registration house officer.

Jones and colleagues' (2002) study differentiated competencies into two groups: general competencies and specific skills. Graduates were asked to rate how well the course prepared them to have the competencies needed in the workplace. Graduates were asked to rate their answer on a five point scale from "not at all well prepared/competent" to "very well prepared/competent" and the mid-point label was "quite well prepared/competent". Table 2.2 depicts the complete competencies used in Jones and colleagues' (2002).

Table 2.2
Graduates' competencies used in Jones et al. (2002).

| Competencies | *p* |
|---|---|
| General Competencies | |
| History taking, clinical examination, selection, and interpretation of diagnostic tests | ns |
| Understanding disease processes | <.01 |
| Communicating effectively | <.01 |
| Being aware of your own limitation | ns |
| Working in a team | <.01 |
| Recognition of the social and emotional factors in illness and treatment | <.01 |
| Keeping accurate records | ns |
| Using opportunities for disease prevention and health promotion | ns |
| Managing time effectively | ns |
| Making the best use of laboratory and other diagnostic services | ns |
| Understanding the relationship between primary, social care, and hospital care | <.01 |
| Developing appropriate attitudes towards personal health and well being | <.01 |
| Understanding the principles of evidence-based medicine | <.01 |
| Diagnosis, decision making and the provision of treatment including prescribing | ns |
| Coping with uncertainty | <.01 |
| Understanding the purpose & practice of audit, peer review and appraisal | <.01 |
| Providing appropriate care for people of different cultures | <.01 |
| Using informatics as a tool in medicine practice | <.01 |
| Being aware of legal & ethical issues | <.01 |
| Specific skills: | |
| Venepuncture | <.01 |
| Basic CPR | ns |
| Arterial blood sampling | ns |
| Administering oxygen therapy safely | ns |
| Urinary catheterisation | <.01 |
| Obtaining valid consent | <.01 |
| Performing an ECG | <.01 |
| Writing prescription | <.01 |
| Control of haemorrhage | ns |
| Calculating accurate drug dosages | ns |
| Correctly using a nebuliser | <.01 |
| Suturing | <.05 |
| Inserting a nasogastric tube | <.01 |

*Note*. *p*: Mann-Whitney significance for the difference between the PBL and non-PBL group.

Prince and colleagues (2005) conducted a graduate survey of one PBL and four non-PBL medical schools. The survey was conducted 18 months after graduation with a total of 1,159 respondents. Graduates were asked about their perceptions of how well their education had

prepared them for medical practice and in general competencies. Table 2.3 depicts the complete list of graduates' competencies used in Prince et al. (2005) study.

Table 2.3 Graduates' competencies used in Prince et al. (2005)

| Competencies | *p* |
|---|---|
| Expert knowledge | <.05 |
| Profession-specific skills | <.01 |
| Computer skills | ns |
| Communication skills | <.05 |
| Teamwork skills | ns |
| Planning and organisation skills | ns |
| Leadership skills | ns |
| Independence | ns |
| Creativity | ns |
| Initiative | ns |
| Dealing with change | ns |
| Accuracy | ns |

*Note*. p: T-test significance for the difference between the PBL and non-PBL group in the frequency of competencies usage.

Hoffmann and colleagues' (2006) study sought to compare the performance of ten cohorts of PBL graduates with non-PBL graduates on United States Medical Licensing Examination (USMLE). Graduates were from the University of Missouri Colombia School of Medicine (UMCSOM) matriculated from 1993 to 2006. Additionally the study also included residency directors evaluations of UMCSOM. The complete list of the competencies indicators used in Hoffman and colleagues' (2006) study can be seen in Table 2.4.

Schmidt, Vermeulen, and van der Molen (2006) conducted a study on the long term impact of PBL method in comparison with conventional method. The study used 18 indicators of competencies which are listed in Table 2.5.

Table 2.4
Graduates' competencies used in Hoffman, et al. (2006)

| Competencies | *p* |
|---|---|
| General fund of knowledge | <.01 |
| Physical diagnosis and history taking | <.01 |
| Ability to manage expected number of patients | <.01 |
| Medical judgment/ability to perform under pressure | <.05 |
| Quality of written presentations | <.01 |
| Quality of oral presentations | <.01 |
| Effectiveness with patients | <.05 |
| Ability to teach medical students | <.01 |
| Communication with others on health-care team | <.01 |
| Level of maturity | <.01 |
| Willingness to accept responsibility | <.01 |
| Initiative | <.01 |
| Willingness to help others | ns |
| Ability to accept criticism | <.01 |
| Self-confidence | ns |
| Sensitivity to psychosocial needs of patients | ns |
| Projects qualities of a good physician | <.01 |

*Note*. *p*: T-test significance for the difference between the PBL and non-PBL group from the perspective of residency directors.

Table 2.5
Graduates' competencies used in Schmidt, et al. (2006)

| Competencies |
|---|
| Problem-solving skills |
| Collaboration skills |
| Possession of profession-relevant knowledge |
| Interpersonal skills |
| Skills relevant to running meetings (e.g. chairing a meeting) |
| Writing reports or articles |
| Paper presentation skills |
| Research skills |
| Self-directed learning skills |
| Use of information resources |
| Professional skills (such as physical examination |
| Producing new ideas for doing one's work in a better way |
| Helping colleagues |
| Productivity |
| Ability to work independently |
| Planning skills |
| Efficiency, time management |
| Ability to work under pressure |

The studies reviewed in this section give a basic overview about graduates' competencies in medical education literature. The development of graduates' competencies indicators in this study will be based on this literature. The complete development of the indicators will be elaborated further in Section 3.2.3.

## 2.3 The effects of PBL on graduates' competencies

This section elaborates on the relationship between PBL and graduates' competencies. The main discussion will review studies investigating the effect of PBL, as a component of learning environment, on graduates' competencies.

Vermeulen and Schmidt (2008) summarized that learning environment consists of three components. The first is the extent to which informal and personal interaction between staff and students is possible. This component includes some issues such as support, cooperation, and response from staff; frequent feedback from staff; teachers' didactics skills and motivational skills; professional development of teachers; and students who are engaged and perceive that they are supported and benefit from their higher education experiences.

The second component of the learning environment that may influence student learning is their interaction with peers. High-quality interaction between students and between students and faculty around intellectually meaningful subjects increases students' learning outcomes (Vermeulen & Schmidt, 2008).

The third component of the learning environment that influences student learning is the curriculum. Curriculum that is well organized, consisting of fascinating, coherent topics, with opportunities to specialise in particular subject will motivate students to get involved in the subject-matter. Another component of a well-thought-out curriculum is that it should encourage the acquisition of academic skills, critical thinking abilities, occupational competencies, allow differentiation in learning, adaptable to students' pace of learning, and provide appropriate assessment with sufficient learning tools. Additionally the curriculum should be designed for the students to be able to finish it within the allocated time. The feasibility of completing the program will motivate the students (Vermeulen & Schmidt, 2008).

Regarding curriculum, Kember (2004) elaborated the importance of several aspects in producing curriculum that improved the quality of student learning. Kember stated that in order to produce a curriculum which will motivate students to work hard towards high-quality learning outcomes, attention needs to be given to the following aspects: (1) a coherent programme of courses or subjects with a transparent relationship between components; (2) teaching which concentrates on key concepts and promoting understanding; (3) assessment which tests understanding; (4) an approach to teaching which requires active engagement of student-projects; (5) teachers accepting responsibility for motivating students and stimulating interest; (6) promotion of a climate in which student-student relationships and class coherence can develop –particularly through group discussion, assignments, and projects; and (7) developing warm, supportive teacher-student relationships.

Considering the characteristics of PBL described in section 2.1, it is obvious that PBL curriculum has met the demand of Vermeulen and Schmidt's (2008) and Kember's (2004) criteria of curriculum that improves student learning. With this argument, PBL will improve student learning and have a positive impact on graduates' competencies.

There are a limited number of studies which focus on the direct output of PBL in the world of work. However, some studies noted that PBL implementation had a positive impact on graduates' competencies.

Jones (2002) reported that graduates rated PBL courses significantly more effective than non-PBL. The PBL course was significantly more effective in preparing students for 12 of the 19 broad competencies and eight of 13 specific skills (see Table 2.2 for the complete statistics). In general competencies there were no significant differences between both tracks in seven competencies. While in the specific skills there were no differences between the two groups in five attributes namely: basic CPR, arterial blood sampling, administering oxygen therapy safely, control of haemorrhage, and calculating accurate drug dosages.

The non-PBL graduates on the other hand rated their understanding of disease process higher than the PBL graduates; however there was no difference in the rating given by the educational supervisors. Additionally, the supervisors rated PBL as better in preparing graduates in five competencies: communicating effectively; coping with uncertainty; understanding the purpose and practice of audit, peer review and appraisal; providing

appropriate care for people of different cultures; and being aware of legal and ethical issues (Jones, 2002).

Prince et al. (2005) conducted a survey to graduates from one PBL and four non-PBL school 18 months after graduation. They reported that, compared with their non-PBL colleagues, the PBL graduates rated themselves as having better expert knowledge, profession-specific skills, and communication skills. There were, nevertheless, no differences among the two groups of graduates in computer skills, teamwork skills, planning and organisation skills, leadership skills, independence, creativity, initiative, dealing with change, and accuracy. PBL graduates also reported that their training and preparation for practice was higher in quality than graduates from other school. More than half of the PBL graduates stated that they had acquired communication skills mainly in medical education, while only a quarter of non-PBL graduates said so. Additionally the PBL graduates gave higher ratings for the connection between higher education and work, their medical training, and preparation for practice.

Schmidt, Vermeulen, and van der Molen (2006) conducted a study on the long term impact of PBL curriculum. The study reported that graduates of PBL higher education institutions scored higher on most professional competencies indicators. Graduates of PBL institutions reported having much better interpersonal skills, better competencies in problem solving, self-directed learning, information gathering, and somewhat better task-supporting skills, such as the ability to work and plan efficiently. However, there were no sizeable differences with regard to general academic competencies, such as conducting research or writing papers. Graduates from the conventional school rated themselves as having slightly more medical knowledge.

Hoffman and colleagues' (2006) study concentrated on the evaluation of residency directors to the performance of graduates in their first year residency before and after implementation of PBL. The result of their study asserts that from 17 competencies comparisons, 12 were significant. Graduates from PBL approach received higher scores from the program directors than did their counterparts from conventional method. The result of graduates' performance from residency directors' perspective is listed in Table 2.4.

A more recent study regarding the longitudinal effects of PBL and conventional learning was conducted by Cohen-Schotanus et al. (2008). The result of Cohen-Schotanus and colleagues'

study showed different variation than other studies investigating the longitudinal effects of PBL. The study showed that PBL graduates rated themselves higher in communication skills, scientific skills, clinical problem solving, dealing with the social context of patients, and clinical knowledge. However there was no difference on clinical competence between PBL and non-PBL group. The clinical competencies were assessed at the end of clinical clerkship rotation by clinical specialist of the discipline. The clinical specialist rated global clinical performance on a scale of 1 "poor" to 10 "excellent". Commenting on this result Cohen-Schotanus and colleagues (2008) stated that the clinical clerkship rotation evaluation consisted not only of clinical competencies but also theoretical knowledge. They found that PBL students rated themselves more highly on competencies, while the conventional students rated themselves higher on basic science knowledge. These aspects may have neutralised each other in the clerkship grades.

Another study, based on the data of a graduate survey in ten countries with 3,476 respondents, compared two groups of graduates (Patria, 2011). One group of medicine graduates who studied in institutions which have high emphasis on PBL (group 1) and another group who studied in institutions with less emphasis on PBL (group 2). The result of the analysis indicated that there were significant differences of competencies between both groups. Group 1 reported higher competencies in leadership, personal working skills, organisational skills, interpersonal skills, field-related knowledge, and basic communication skills.

Even though there was variety in the competencies indicator used and the comparison results, the aforementioned studies generally depicted that PBL graduates have a better competencies than non-PBL graduates. The characteristics of PBL (i.e. learning is student-centred; learning occurs in small group; teacher as facilitator; using problems as the stimulus of learning; real-world problems; and new information is acquired through self-directed learning) enables students to practice competencies used in their future work as physicians while still at medical school. This makes the graduates of PBL better in preparing for professional practice than non-PBL graduates.

## 2.4 Summary

Besides offering a general introduction of problem-based learning (PBL), this chapter also briefly discussed its rapid dissemination which leads to various interpretations and modification of PBL. The chapter also explored the role of the teacher in PBL which is considered by experts as the main difference between PBL and other methods.

An abundance of studies showed that PBL have positive impacts on learning process and outputs. Nevertheless, PBL literature is enriched by the debates that PBL is less effective than conventional methods. Studies based on meta-analysis found that PBL is less effective compared to a conventional approach in term of knowledge and results of standardized test. For example, PBL students scored lower on basic science examinations (Albanese & Mitchell, 1993; Nandi, et al., 2000). Students of PBL and conventional methods did not differ on test of factual knowledge and test of clinical knowledge (Vernon & Blake, 1993). There was no convincing evidence that PBL improves students' knowledge base and clinical performance (Colliver, 2000).

Researchers who favour PBL defended the effectiveness of PBL by striving to evaluate and improve the research methods in PBL studies. This includes the suggestion to use a clearer criteria in choosing the studies used in the meta-analysis or systematic review (Albanese, 2000; Wolf, 1993); a more reasonable effect-size expectation (Albanese, 2000). There was also criticism that meta-analysis studies reduce complex literature into a single number therefore losing the richness and information of the original study (Distlehorst, 1994; Wolf, 1993). An attempt to improve the method in meta-analysis studies was conducted by addressing potential moderators of PBL effects (Dochy, et al., 2003) and the inclusion of only quasi-experiment studies in the analysis (Gijbels, et al., 2005).

Even though PBL was developed considering neither educational psychology nor cognitive science (Barrows, 2000), the literatures showed that there are some aspects of cognitive psychology and educational theory that supported the PBL process (e.g. Gijselaers, 1996; Glaser, 1991; Norman & Schmidt, 2000). This chapter also elaborated how cognition and educational theory are supported in each PBL processes.

The competencies section of the chapter corroborated the literatures of competencies in the context of the relation between higher education and the world of work. The subsequent

discussion revolves around how various set of competencies set were used in PBL studies. This is essential for background information on the development of competencies indicators in Chapter 3 and 5.

The literature chapter closed with the reviews on the relationship between PBL and graduates' competencies. PBL as a part of learning environment, especially the curriculum, has met the criteria of learning environment that improves student learning output (Kember, 2004; Vermeulen & Schmidt, 2008). Therefore, PBL implementation is expected to have a positive impact on graduates' competencies.

PBL literatures mentioned in the present and previous chapter provide the necessary context for the present study. PBL implementation needs a lot of resources (Albanese & Mitchell, 1993; Finucane, et al., 2009), therefore the implementation is more achievable in a less than curriculum-wide mode (Albanese, 2000). This means implementing only few components of PBL according to the institutions' goal and limited resources. This leads to a need to identify PBL components and their effect on particular educational outcomes (Hmelo-Silver, 2004; Hmelo-Silver, et al., 2006; Newman, 2003). Additionally, this study proposes the importance of evaluating PBL implementation. Prior studies tend to base their investigation on the assumption that all PBL implementations are standardized. However, as any other method of teaching and learning, PBL could be poorly executed which also leads to a poor educational outputs. Therefore to provide a better research method than previous studies, PBL implementation should be first evaluated before further research in PBL educational outputs.

The next chapter illustrates the methods used in this study which include the subject, instruments, procedure and data analysis involved in the study.

# 3 Methods

This chapter explains the methods used in this study. This study is a quantitative study based on survey design. The data were gathered from a cross-sectional survey addressed to the graduates of the Faculty of Medicine, Gadjah Mada University, Indonesia.

The subsequent sections describe the characteristics of the subjects, including overviews of the research setting (medical education in Indonesia). Explanation of the instrument development and the survey procedures are presented afterwards. In addition, the explanation of the quantitative data analysis is presented to provide background information for further discussions in the proceeding chapters.

## 3.1 Subject

### 3.1.1 Medical education in Indonesia

Medical education in Indonesia is based on the Standard of Professional Doctor Education developed by Indonesian Medical Council. The standard was developed to guide medical education institutions to conduct medical education processes. With this guide, medical education institutions are expected to produce medical doctors with standard qualifications.

The structure of medical education curriculum in Indonesia consists of two phases: bachelor in medicine, and professional medicine. The bachelor level requires students to pass minimum of 144 credits, which is conducted in seven semesters. The graduates are awarded Bachelor in Medicine title or in Bahasa Indonesia S.Ked (*Sarjana Kedokteran*).

In the professional medicine phase students conduct a medical internship or clerkship in an educational hospital for a minimum of 72 weeks or equal to 2,880 hours. After finishing the internship the graduates will be awarded a *dokter* or dr. (Medical Doctor) (IMC, 2006).

#### 3.1.1.1 Faculty of medicine Gadjah Mada University

The faculty of medicine Gadjah Mada University (UGM) was one of the first faculties established after the foundation of UGM in 1946. Since that year, the medical education has been changing from one system to another. In 1992, the faculty of medicine UGM implemented Problem-based learning (PBL) for the new students; the students from previous cohorts still used the conventional curriculum. The curriculum was called BBM (Belajar Berdasar Masalah), in English: learning based on problems.

Besides the regular program, which is taught in Bahasa Indonesia, the faculty of medicine UGM also have international program taught in English. In the academic year of 2002/2003 a full PBL method was implemented in the curriculum of international program and was followed by the regular program in 2003/2004. The curriculum consisted of 22 blocks, including one elective block. Each block is equal to seven credits semester.

The study duration lasts for five years and consists of three phases: foundation of medicine, transition from theory to practice, and clinical rotation phase. For the first three and a half years students have to take 21 blocks. Each block lasts for seven weeks. At the end of every block there will be a block examination. A progress test and clinical skills exam are conducted after every three blocks. The first comprehensive exam is conducted at the end of phase two (transition from theory to practice) and the second comprehensive test is conducted in the end of clinical rotation phase. The complete map of PBL implementation in UGM can be seen in Table 3.1.

Table 3.1
Curriculum map of medical education in Gadjah Mada University

| | | | | | | |
|---|---|---|---|---|---|---|
| Phase 1: Foundation of Medicine<br>Year 1: The Human Body System and Basic Medical Practice | | | | | | |
| Block 1.1 Being Medical Student &Locomotor System | Block 1.2 Cardiorespiratory System | Block 1.3 Digestive System | Block 1.4 Genito-urinary System | Block 1.5 Nerve System, Endocrine, Senses | Block 1.6 Basic Medical Practice | Holiday |
| Phase 2: Transition from Theory to Practice<br>Year 2: Life Cycle and Acute Disorders | | | | | | |
| Block 2.1 Safe Motherhood | Block 2.2 Conception, Fetal Growth &Newborn | Block 2.3 Childhood | Block 2.4 Adolescent | Block 2.5 Adulthood | Block 2.6 Aging/Elderly | Holiday |
| Phase 2: Transition from Theory to Practice<br>Year 3: Multisystem and Chronic Disorders | | | | | | |
| Block 3.1 Chest complaints | Block 3.2 Abdominal Complaints | Block 3.3 Limited Movement | Block 3.4 Neurosensory Complaints | Block 3.5 Life Style Related Complains | Block 3.6 Elective/Research | Holiday |
| Phase 2: Transition from Theory to Practice<br>Year 4: Emergency & Disaster | | | Compre Exams | Phase 3: Clinical Rotation - Becoming a Competent Doctor - Year 4 | | |
| Block 4.1 Emergency | Block 4.2 Health System & Disaster | Block 4.3 Research | | | | |
| Phase 3: Clinical Rotation - Becoming a Competent Doctor<br>Year 5 | | | | | | |
| Clinical Rotation | | | | | | Compre Exams 2 |

Block examination
Progress Test & Clinical Skills Exams

*Note*. Every block lasts for 7 weeks

### 3.1.2 Characteristics of the subject

The subjects of this study were young graduates from the Faculty of Medicine Gadjah Mada University. In this study, graduation refers to the time when students finished the clinical rotation phase and were awarded a medical doctor title (MD.) or in bahasa Indonesia *dokter* (dr.).

Participants in the survey were graduates who graduated between February 5th, 2009 and July 8th, 2011. This means graduates were surveyed from eight months to three years after

graduation. The total number of graduates during that time was 719, with gender composition of 54.2 % female and 45.8% male.

A total of 225 graduates participated in this study. The gender proportion of the dataset (54.2% female and 45.8% male) was equal with the proportion of the population. Graduates' average age, when the survey was conducted, was 26.3 years old (*SD* = 2.27, *M* = 26). The composition of graduates from regular and international program was 86.1% (*n*=186) and 13.9% (*n*=30) respectively.

The time span from eight months to three years was chosen considering three reasons. The first reason was because of the availability of the addresses. The graduates address database for the last three years was more comprehensive compared to the earlier time.

Second, three years after completing their study, graduates are expected to have stable employment. The three year span is also the proper time considering graduates who continue to study. By this time graduates who continue with post-graduate education have already graduated. Graduates who continue directly to a medical specialisation program have not finished the program because specialisation program lasts for approximately five years. However, they are mostly already employed, therefore could provide information about their experience in the labour market.

Third, this study relied partly on the retrospective perspective of graduates on their study condition and environment. The fresh graduates would be the best source for this information. Therefore, the fresh graduates (eight months after graduation) were included in this study.

Table 3.2
Start of the study by gender (percent)

| | Female | Male | Total |
|---|---|---|---|
| 2002 and before | 9 | 10 | 9 |
| 2003 | 18 | 17 | 18 |
| 2004 | 28 | 28 | 28 |
| 2005 | 45 | 45 | 45 |
| Total | 100 | 100 | 100 |
| Count | 122 | 103 | 225 |

*Note*. Question B1: What was the start and graduation date of your study in medicine?

Graduates were mostly from the cohort of 2005, 2004, and 2003 (45%, 28% and 18% respectively). Only few graduates were from the cohort of 2002 and earlier (9%). Table 3.2 shows the starting year of graduates' in the faculty of medicine by gender.

Only 12% of graduates had secondary education abroad, most of the graduates (88%) completed secondary education in Indonesia. Graduates who had secondary education abroad mostly attended the international program. The predominantly came from Malaysia (the neighbour country of Indonesia), few from Myanmar, Cambodia, and Germany.

## 3.2 Instruments

The main instrument used in this study was a graduate survey questionnaire, mainly in an online version. A paper questionnaire was also provided for graduates who requested them. The paper version was prepared because some graduates were working in remote areas with limited internet access.

The questionnaire consists of two main parts: standard questions related to graduate surveys and questions related to PBL measurement.

The questionnaire was first developed in English then translated to Bahasa Indonesia (Indonesian) with the help of a professional translator. The questionnaire in both languages can be found in the Appendix.

The questionnaire produced a dataset of 400 variables, including metadata such as PIN (personal identification number), login frequencies, accessed time, and completion rate. The following sections describe the themes and variables included in the questionnaire. The graduate survey's standard variables will be presented first followed by the PBL part.

### 3.2.1 Standard variables in graduate survey

The questionnaire included standard themes measured in graduate surveys, e.g., graduates' socio-biographic information, study conditions, transition process from higher education to work, and employment condition. Table 3.3 lists the complete themes addressed in this study.

Table 3.3
Themes addressed in the questionnaire

- Socio-biographic and early education background
- Course of study and study activities
- Job search and sequence of professional activities
- Current activities, employment and work
- Work content and use of qualifications
- Professional orientation and satisfaction

The questionnaire was developed mostly based on the approaches and experiences of former international graduate survey, i.e. CHEERS (Careers after Higher Education: a European Research Study) (WZ1, 2000).

The subsequent sub-sections elaborate the development of Problem-based learning and graduates' competencies questionnaire.

### 3.2.2 Problem-based learning

This section presents the theoretical notion underlying the items development for each factor of problem-based learning (PBL) questionnaire. A more thorough discussion on the psychometric properties of the questionnaire are presented in Chapter 4.

The questionnaire was developed based on PBL characteristics from Barrows (1996). Those characteristics are: learning is student-centred; learning occurs in small group; teacher as facilitator; using problems as the stimulus of learning; the problems should reflect the real-world; and new information is acquired through self-directed learning (Barrows, 1996). The complete factors of the PBL implementation questionnaire are listed in Table 3.4.

Table 3.4
Factors measuring PBL implementation

1. Student-centred learning
2. Small group
3. Problem as stimulus
4. Real-world problems
5. Teacher as facilitator
6. Self directed learning

The graduates were asked to rate their responses on each factor indicators based on the question: "To what extent were the following statements match with the conditions in your study course?" The graduates rated their responses on a five point scale ranging from 1 "Not at all" to 5 "To a very high extent". The complete questionnaire can be seen in the Appendix.

The draft of the questionnaire was checked by experts in PBL research and methodology. The draft of the PBL questionnaire was sent to one expert at Rutgers University, USA; one at School of Medicine and Public Health, University of Wisconsin-Madison, USA; and to three experts at the University of Maastricht, the Netherland. All experts are known for their publications in peer-reviewed journal. Additionally, the questionnaire was also check by quantitative methodology expert at the University of Kassel, by PhD students in medicine and by medical doctors graduated from Gadjah Mada University.

The development of the indicators of each factor in PBL questionnaire and its theoretical base were elaborated in the subsequent sub-sections.

#### 3.2.2.1 Student-centred learning

The items in the Student-centred learning (SCL) factor were developed from several definitions. Brandes and Ginnis (1986) presented the main principles of student-centred learning:

- the learner has full responsibility for her/his learning
- involvement and participation are necessary for learning
- the relationship between learners is more equal, promoting growth, and development
- the teacher becomes a facilitator and resource person
- the learner experiences confluence in his education (affective and cognitive domains flow together)
- the learner sees himself differently as a result of the learning experience.

Fay (1988) stated that SCL is an approach which recognises the integrity and freedom of individual and attempts to convert the teaching/learning process accordingly. Fay further added that SCL is more about attitudes and relationships than about systems; it can be developed in a variety of settings including in the traditional one. Additionally, Fay stated, "It [SCL] rejects learner dependence and, contrary to popular misconception, does not

necessarily stress independence; rather it tries to achieve, on a fully democratic model, interdependence" (Fay, 1988, p. 8).

Cannon and Newble (2000) defined student-centred learning (SCL) as:

> ways of thinking and learning that emphasize student responsibility and activity in learning rather than what the teachers are doing. Essentially SCL has student responsibility and activity at its heart, in contrast to a strong emphasis on teacher control and coverage of academic content in much conventional, didactic teaching. (p. 16)

Lea and colleagues (2003) summarise literatures on Student-centred learning and concluded that Student-centred learning embodies the following principles:

- the reliance upon active rather than passive learning
- an emphasis on deep learning and understanding
- increased responsibility and accountability on the part of the student
- an increased sense of autonomy in the learner
- an interdependence between teacher and learner
- mutual respect within the learner teacher relationship
- and a reflexive approach to the teaching and learning process on the part of both teacher and learner.

Even though these definitions have various emphases, researchers seem to agree on the underlying ideas that SCL includes: autonomy of students in the process of learning, students should actively engage in the learning process, and a more equal role between students and teacher. Based on definitions mentioned before, in this study SCL factor was measured by the items listed in Table 3.5.

Table 3.5
Indicators of Student-centred learning

| |
|---|
| - Students are responsible for their own learning |
| - Students are actively involved in the process of learning |
| - Students have autonomy in the process of learning |
| - Teacher is not the main source of information |
| - Equal role of teacher and students (interdependence) |
| - Emphasis on deep learning |

#### 3.2.2.2 Small groups

Barrows (1996) stated that the original PBL, developed at McMaster University, used small student-groups consisting of five to nine students. Norman and Schmidt (1992) stated that the small group discussion in PBL promotes the elaboration of knowledge at the time of learning. The small size of the group encourages more active participation of every member.

Elaboration can take several forms, e.g. discussion, note-taking, answering questions, and using knowledge to understand a problem. The process of elaboration of knowledge will enhance the retrieval process (Norman & Schmidt, 1992).

Steinert (2004) conducted a study about students' perception of effective small group teaching in preclinical undergraduate medical education. One of the aims of the study was to answer: what makes for an effective small group? The results showed that students identified tutor characteristics as an important component of an effective group. In addition, the students highlighted the importance of: (1) a positive, nonthreatening group atmosphere; (2) active student participation and group interaction; (3) adherence to group goals; (4) clinical relevance and integration; and (5) the effective use of certain pedagogical materials (e.g. cases) that promote thinking and problem solving.

In this study the Small group factor was measured by the indicators listed in Table 3.6.

Table 3.6
Indicators of Small group

| |
|---|
| - Learning process occurs in a small group (5-9 students) |
| - The group size is appropriate to stimulate group discussion |
| - The learning groups have positive atmosphere (non-threatening) |
| - The group size is appropriate to encourage active student participation |

#### 3.2.2.3 Problem as stimulus

Majoor and colleagues (2008) suggested that a PBL problem should fulfil four criteria. A PBL problem should: (1) match the students' level of knowledge, (2) motivate students for further study activities, (3) be suitable for the process of analysis to be applied, and (4) direct the students inevitably to confrontation with the faculty's educational objectives (Majoor, Schmidt, Snellen-Balendong, Moust, & Stalenhoef-Halling, 1990).

A newer study with the Delphy technique (Marchais, 1999) identified the criteria for constructing problems in PBL. Nine criteria were identified and rank-ordered according to their importance: (1) stimulating thinking, analysis, and reasoning, (2) assuring self-directed learning, (3) using previous basic knowledge, (4) proposing a realistic context, (5) leading to the discovery of learning objectives, (6) arousing curiosity, (7) choosing topics related to public health, (8) assuring contextual breadth, and (9) choosing an appropriate vocabulary. Items measuring Problem as stimulus were created based on these criteria.

The complete items measuring Problem as stimulus aspect are presented in Table 3.7. Some items from Marchais' (1999) study were excluded because they were more suitable as the indicators of Real-world problem, which is elaborated in the next section (3.2.2.4).

Table 3.7
Indicators of Problem as stimulus

| The problems in the tutorial process… |
|---|
| - …match with students' level of knowledge |
| - …stimulate thinking, analysis, and reasoning |
| - …assure self-directed learning |
| - …activate students' prior knowledge |
| - …lead to the discovery of the learning objectives |
| - …arouse students' curiosity |
| - …use appropriate vocabulary |

#### 3.2.2.4 Real-world problems

The Real-world problems factor was developed from the criteria for constructing problems in PBL by Marchais (1999). An additional item was constructed based on Barrows' suggestion that the problems must be presented as ill-structured problems (as cited in Savery, 2006). Ill-structured problems stimulate learners to generate multiple hypotheses about its cause and possible solution. The complete items measuring Real-world problem are presented in Table 3.8.

Table 3.8
Items measuring Real-world problems

| |
|---|
| - The problems in the tutorial process are realistic |
| - The problems in the tutorial process are clinically relevant |
| - The problems in the tutorial process related to a public health topic |
| - The problems in the tutorial process generate multiple hypotheses about their cause and solution |

#### 3.2.2.5 Teacher as facilitator

The indicators of Teacher as facilitator are mostly adapted from a tutor effectiveness questionnaire developed by Dolmans and Ginns (2005). Dolmans and Ginns (2005) developed a short questionnaire to evaluate tutor effectiveness in PBL. The questionnaire consists of 11 items representing five underlying factors. The students were asked to rate the items on a scale from 1 'strongly disagree' to 5 'strongly agree'. The result of confirmatory factor analysis demonstrated that the model had a good fit to the data. The internal consistencies of the factors, shown by the Cronbach's alpha reliability coefficients, were acceptable. The complete list of items and factors of the questionnaire is shown in Table 3.9.

Table 3.9
Effectiveness of tutor questionnaire by Dolmans and Ginns (2005)

| | Alpha coefficient |
|---|---|
| F1: Constructive/active learning | .95 |
| - Summarizing in own words | |
| - Searching for links between topics | |
| - Understanding mechanisms/theories | |
| F2: Self-directed learning | .79 |
| - Generation of learning issues by students | |
| - Searching for various resources | |
| F3: Contextual learning | .89 |
| - Application of knowledge to problem | |
| - Application of knowledge to other situations | |
| F4: Collaborative learning | .93 |
| - Giving constructive feedback | |
| - Evaluation of group co-operation | |
| F5: Intra-personal behaviour | .83 |
| - Knowledge about strengths/weaknesses as tutor | |
| - Motivation for tutor role | |

*Note*. Source: Dolmans and Ginns (2005, p. 356)

The self-directed learning factor in tutor effectiveness questionnaire was excluded because the present study already had the same factor which is described in the next section (3.2.2.6). The complete indicators of Teacher as facilitator are listed in Table 3.10.

Table 3.10
Indicators of Teacher as facilitator

| |
|---|
| – The tutors have a clear picture about their strengths/weaknesses as a tutor |
| – The tutors are clearly motivated to fulfil their role as a tutor |
| The tutors stimulate the students |
| – …to summarize what they had learnt in their own words |
| – …to search for links between issues discussed in the tutorial group |
| – …to understand underlying mechanisms/theories |
| – …to apply knowledge to the discussed problem |
| – …to apply knowledge to other situations/problems |
| – …to give constructive feedback about our group work |
| – …to evaluate group co-operation regularly |

#### 3.2.2.6 Self-directed learning

The Self-directed learning factor in this study was developed based on the definition of self-directed learning by Knowles (as cited in Brockett, 1982):

> In its broadest meaning, 'self-directed learning' describes a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. (p.18)

Additional items were created based on self-directed learning definition by Barrows (2000). Barrows (2000) asserted that self-directed learning also consisted of self-monitoring and self-assessment components. The complete indicators of self-directed learning are listed in Table 3.11.

Table 3.11
Indicators of self-directed learning

| |
|---|
| Students take initiative in diagnosing their learning needs |
| Students formulate the learning goals |
| Students decide the resources (human and material) for learning |
| Students choose appropriate learning strategies |
| Students evaluate the accuracy and value of the resources |
| Students self-monitor their learning progress |
| Students self-assess their learning outcome |

### 3.2.3 Graduates' competencies

Studies of the effects of PBL on graduates' competencies used various indicators to measure competencies (e.g., Hoffman, et al., 2006; Jones, et al., 2002; Mennin, et al., 1996; Prince, et al., 2005; Schmidt, et al., 2006) (see Chapter 2 Section 2.2.1, for the complete indicators used in those studies).

In this study a set of competencies was developed to measure graduates' competencies. The items measuring graduates' competencies were mainly developed based on the competencies list used in the CHEERS questionnaire.

The general competencies in CHEERS covered all specific items used in the aforementioned studies. For example, Field-specific knowledge of methods and Field-specific theoretical knowledge were intended to measure professional knowledge and skills as a physician. Other researchers used different indicators for measuring professional knowledge and skills as a physician, such as: *doctor-patient relationship* and *diagnostic skills* (Mennin, et al., 1996); *profession-specific skills* and *expert knowledge* (Prince, et al., 2005); *physical diagnosis and history-taking* and *patient management* (Hoffman, et al., 2006); and Jones et al. (2002) used the term: *recognition of social and emotional factors in illness and treatment*; *understanding the relation among primary, social and hospital care*; *attitudes toward personal health and well-being*; and *understanding principles of evidence-based medicine*.

However, not all CHEERS items measuring competencies were used in this study. Some items were excluded for the following reasons.

First, items which have a low correlation with the total score of the competencies were not included. Field (2005) stated that in a reliable scale all items should correlate with the total.

He further suggested excluding any items with an item-total correlation coefficient below 0.3 (Field, 2005). In this regard, preliminary analysis was conducted to check the item-total correlation of the competencies items in CHEERS study. The data used in the preliminary analysis were from CHEERS research project (Patria, 2009). Two items were excluded from the competencies set because the item-total correlation coefficient was below 0.3. Those items were: *foreign language proficiency* ($r_{it}$= .20) and *computer skills* ($r_{it}$= .25). By removing these two items the Alpha reliability was increased from .925 to .928 which indicated a better internal consistency.

Second, some items were removed concerning the relationship between PBL implementation and graduates' competencies. The subsequent statistical analysis in this study was concerned with the effect of PBL implementation on graduates' competencies. Therefore, it is necessary to consider also the relevant prior research in the selection of competencies items. Prior research, based also on CHEERS data, showed that in some competencies there were no differences between PBL and non-PBL group (Patria, 2009). Those items were: learning abilities ($t$(2108.12) = -.29, $p$ = ns); fitness for work ($t$(2127.32) = 1.30, $p$ = ns); assertiveness, decisiveness, persistence ($t$(2136.07)= .39, $p$ = ns); and getting personally involved ($t$(2144.78)= 1.93, $p$ = ns) (Patria, 2011).

Third, in the process of assuring construct validity (face validity), two items were not understood by the graduates, those items were: *fitness for work* and *manual skills*. Therefore these two items were also removed from the list.

Additional items were added to the competencies list because they were not represented in the CHEERS's list. Those items are: *collaboration skills, self-directed learning skills* (Schmidt, et al., 2006) and *coping with uncertainty* (Jones, et al., 2002; Mennin, et al., 1996). PBL and non-PBL group reported different level of these competencies (Koh, et al., 2008).

Researchers usually used exploratory factor analysis (EFA) to aggregate competencies indicators into their underlying factor. This method reduces the complexity of the data, thus increasing its interpretability. In this study the result of EFA yielded four factors of graduates' competencies: Interpersonal skills, Leadership, Organisational skills, Field-related competencies, and Personal working skills. The factor naming was based on prior research on graduates' competencies (i.e. Patria, 2011; Schmidt, et al., 2006).

Patria (2011) conducted exploratory factor analysis (EFA) on graduates' competencies indicators and yielded seven factors: Leadership, Personal working skills, Organisational skills, Interpersonal skills, Field-related knowledge, Basic communication skills, and Special skills. Whereas Schmidt et al. (2006) aggregated graduates' competencies into four factors: interpersonal competencies; PBL-related, cognitive competencies; general academic competencies; and task-supporting competencies.

Table 3.12
Indicators of graduates' competencies

| | Mean | SD | Alpha |
|---|---|---|---|
| Personal / Organisational skills | | | .928 |
| Reflective thinking, assessing one's own work | 3.78 | .709 | |
| Initiative | 3.75 | .685 | |
| Analytical competencies | 3.82 | .690 | |
| Working independently | 3.98 | .728 | |
| Problem-solving ability | 3.72 | .670 | |
| Taking responsibilities, decisions | 3.78 | .701 | |
| Working in a team | 3.93 | .669 | |
| Loyalty, integrity | 3.97 | .637 | |
| Working under pressure | 3.73 | .841 | |
| Leadership | | | .896 |
| Understanding complex social, organisational and technical systems | 3.34 | .815 | |
| Planning, co-ordinating and organising | 3.52 | .810 | |
| Economic reasoning | 3.30 | .891 | |
| Applying rules and regulations | 3.55 | .829 | |
| Negotiating | 3.57 | .771 | |
| Documenting ideas and information | 3.57 | .771 | |
| Leadership | 3.62 | .735 | |
| Creativity | 3.66 | .743 | |
| Field related competencies | | | .864 |
| Field-specific theoretical knowledge | 3.66 | .646 | |
| Cross-disciplinary thinking/knowledge | 3.72 | .655 | |
| Broad general knowledge | 3.70 | .633 | |
| Field-specific knowledge of methods | 3.58 | .643 | |
| Self-directed learning skills | 3.85 | .728 | |
| Critical thinking | 3.80 | .690 | |
| Interpersonal skills | | | .838 |
| Tolerance, appreciating different points of view | 3.99 | .614 | |
| Coping with uncertainty | 3.68 | .727 | |
| Collaboration skills | 3.82 | .630 | |
| Adaptability | 3.98 | .663 | |
| Written communication skills | 3.80 | .720 | |
| Oral communication skills | 3.88 | .790 | |
| Total | | | .955 |

Table 3.12 depicts the composition of each factor and the Alpha coefficient. The Alpha coefficient for each factor ranges from .838 to .928 and the total for all items is .955.

In the process of exploratory factor analysis three items were excluded from the final items of graduates' competencies, those items were: *Accuracy, attention to detail*; *Time management*; and *Power of concentration*. Those items were statistically loading to a specific factor; however it failed to fit with the underlying theory of graduates' competencies from prior research (i.e. Patria, 2011; Schmidt, et al., 2006).

## 3.3 Procedures

### 3.3.1 Preparation of the survey process

Preparations before the survey was launched are described in the current section.

#### 3.3.1.1 Development of online questionnaire

The preparation of the survey was started with converting the questionnaire to an online version. Online.QTAFI was used as the system of the online questionnaire. Compared to other online questionnaire system, online.QTAFI has several advantages, e.g. open source, based on XML codebook, supported closed survey, supported advanced filtering and the data are available in multi-format (Patria & Handoko, 2009, November).

The online questionnaire used a closed survey method. This means in order to access the survey graduates have to fill an access-code or PIN (Personal identification number). This is important to control the survey, therefore only eligible graduates could access the online questionnaire.

#### 3.3.1.2 Invitation email

Invitation emails were composed to invite graduates to participate in the survey. Additionally, it was also designed to inform graduates about the survey, its importance, the link to the online questionnaire, and the password to access the online questionnaire. The later invitations (2nd-5th invitations) were also contained up-to-date response rate of the

survey. This was conducted to motivate graduates to login or to finish filling the online questionnaire.

Similar with the questionnaire, the invitation emails were prepared in two languages, Bahasa Indonesia version for graduates from the regular program and English version for graduates from the international program.

A mail merge system was used for sending the invitations to all graduates. The mail merge system makes sure that the respondents get a personalized email with their names and access codes. Additionally, the mail merge system also simplifies the email sending because hundreds of emails could be submitted at once. This study used Thunderbird email client and Mail merge add-ons to manage the emails sending.

The invitation was also intended to encourage graduates to inform their colleagues who have not received the invitation email. Graduates who have not received any invitation email should contact the administrator of the survey to request invitation email by phone or email. When an invitation request is received, the survey administrator checked the eligibility of the graduates before sending the invitation.

To improve the authority, the invitation email was signed by the head of *Bagian Pendidikan Kedokteran* (BPK FK UGM) or Department of Medical Education Faculty of Medicine, Universitas Gadjah Mada.

#### 3.3.1.3 Development of survey website

A survey website was developed in order to inform graduates and other interested parties about the research conducted. The website (http://www.gradmedic.com) had more information about the survey which was impossible to put in the invitation email. The website provided detailed information about who conducted the survey, reasons for participation and data protection policy. The website also answered common questions about filling out the online questionnaire. Complete information about the survey in the website was intended to gain the respondent's trust in the survey which would increase the intention to participate in the survey.

The invitation emails contained a link to the survey's website (http://www.gradmedic.com). In the survey's website, graduates found the link to online questionnaire server located in

University of Kassel, Germany (http://www.hochschulforschung.uni-kassel.de/qtafi/projects/fkugm/). This method has two main advantages. First, in the invitation email, graduates saw only a short address of the website (gradmedic.com instead of hochschulforschung.uni-kassel.de/qtafi/projects/fkugm), thus it was easier to remember.

Second, graduates could easily inform others about the survey. Additionally, the website was also integrated with social networking websites, i.e. facebook and twitter. With only one click, graduates could share the survey information with their colleagues. This would improve the dissemination of the survey. Figure 3.1 shows the front-page of the survey's website.


Figure 3.1 The survey website

### 3.3.1.4 Sampling frame

This study used email and telephone contact as the sampling frame of the survey. Sampling frame is a listing of all units in the target population (Groves, Fowler, Couper, Lepkowski, & Singer, 2004). The list of graduates' emails and telephone numbers was acquired from the

administration office, Faculty of Medicine UGM. A total of 719 graduates were in the list of those who graduated during the targeted time (February 5th, 2009 until July 8th, 2011).

However, sampling frame is sometimes a set of imperfect links to the population members (Groves, et al., 2004). In this study, not all 719 graduates had complete information of email and telephone number. In the contact list, only 648 graduates had email contact and 71 graduates had no record of email addresses. A database updating then conducted to complete the information. The updating process was conducted mainly by directly asking the graduate about their current email address using short message system (SMS). When the telephone number was not available either, an information search was conducted in the internet. Most of the graduates have an account in a social networking website, e.g. facebook. Graduates were then contacted through facebook and asked to provide their newest email addresses.

#### 3.3.1.5 Testing and checking

Before launching the online questionnaire a series of trials were conducted. To make sure the graduates could access the online questionnaire, the access-code was tested before sent to graduates.

A test was conducted to check the coherence of the questions in online questionnaire and the database. Graduates' answers to a specific question in the online questionnaire should go to a specific variable in the database. A test was conducted to make sure that all graduates' responses go to the right cell in the database.

A test was conducted to check the automatic filtering of the online questionnaire. Online.QTAFI, the online questionnaire system used in this study, supported automatic filtering. Based on a graduates answer on a specific question they will skip other specific question(s) which were not applicable to their condition. For example, in question B4 graduates were asked about whether they have spent some time abroad during their study in order to work or study. When a respondent answered "No" then he/she will automatically jump to question B6. On the other hand, when the respondent answered "Yes" then he/she will go to the next question (B5), which asked the graduates about the activities while staying abroad (see Appendix for the complete paper questionnaire). The test was conducted to make sure that the filters lead the respondents to the right question.

To make sure that graduates received the invitation email, a test of the mail merge system was conducted. It was found that university's server could not send hundreds of emails at once. This was due to the restriction in the server that automatically block suspected spamming activities, e.g. sending hundreds of emails at once. Consequently, the graduates email list was divided into several lists which each contained only 25 email addresses.

### 3.3.2 Field phase

The questionnaire was online from March 15th until May 31st, 2012. The survey process was divided into two batches.

#### 3.3.2.1 The first batch

The first batch of the survey was started with sending the invitation email in the middle of March 2012 (04/15). The first batch was scheduled with four follow-up invitations. Follow up invitations were sent to graduates who: (1) had not yet logged in to the online questionnaire, (2) had already logged in but had not finished filling out the online questionnaire. A thank you email was sent to graduates who already had finished filling out the questionnaire.

Usually the term "reminder" is used to refer to contacting graduates after the first invitation. However, the term "reminder" in Bahasa Indonesia (Indonesian) has a negative nuance. Therefore, instead of using "reminder" this study used the term follow-up invitations or 2nd-5th invitations.

The follow-up invitations were scheduled to be sent at two week intervals. However, because in the first two weeks there were still lots of responses coming, the second invitation was delayed until the third week (5/4/2012). This delay was also because the calculation of graduate responses was not finished, and the email address updating was not yet completed. The fifth invitation was sent in May 16th 2012.

Figure 3.2 illustrates time sequence of the email submission process, the first batch is represented by red crosses and the second batch is represented by blue squares.

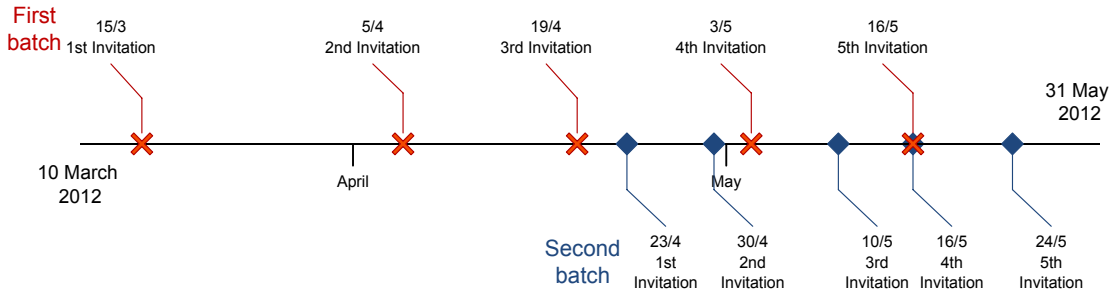



Figure 3.2 Timeline of the invitation sending

#### 3.3.2.2 The second batch

After the first invitation emails were sent in the first batch, there were many undelivered emails. Therefore, an email address updating process was conducted. The new acquired email addresses were then used in the second batch.

The first invitations for the second batch were sent on April 23rd and the fifth invitations were sent on May 24th, 2012. The interval of each invitation was seven days. The reason to use one week interval, instead of two weeks as in the first batch, was in order to finish the second batch survey closely with the first batch.

There were a few inconsistencies in the schedule of email submission because of unavoidable circumstances. For example the third invitation in batch two should have been sent on May 7th, however because of mail server problem, the invitations were sent three days later (May 10th). The fourth invitations in batch two (and the fifth in batch one) were sent one day earlier because the next day (May 17th) was a national holiday.

#### 3.3.2.3 Response rate

In the first invitation, from 648 invitation emails sent to graduates, 526 were delivered and 122 were undelivered. The undelivered indicated that the email addresses were inaccurate (e.g. mistyped) or inactive. The process of updating the addresses database yielded 48 new email addresses. The new email addresses were then used for the second batch.

The total number of invitation emails sent to graduates was 574. When the online survey ended, 254 graduates had accessed the online questionnaire. After reducing incomplete questionnaires (completion rate below 5%) the dataset consisted of 225 respondents.

Groves, et al. (2004) suggested a formula for calculating survey's response rate:

$$\frac{I}{I + R + NC + O + e(UH + UO)} \quad (3.1)$$

$I$ = Completed interview / questionnaire
$R$ = Refusal and breakoff
$NC$ = Noncontact
$O$ = Other eligible
$UH$ = Unknown if household/occupied HU
$UO$ = Unknown eligibility, other
$e$ = Estimated proportion of cases of unknown eligibility that are eligible

Table 3.13 provides the information to calculate the response rate of this study. The available data in this survey were: the completed questionnaire (*I*), number of graduates who refused to answer (*R*), and number of unreachable graduates (*NC*).

Table 3.13
Summary of field phase statistics

| Component | Σ |
|---|---|
| Email sent | 696 |
| Delivered emails | 574 |
| No contact (*NC*) | 320 |
| Breakoff or refusal (*R*) | 29 |
| Questionnaire filled (*I*) | 225 |

The response rate of the present graduate survey, calculated with Equation (3.1) is 225 / (225+29+320) = 0.391 or 39.1%.

Unused email addresses were suspected as the main problem in the field phase. Unused here refers to email addresses that were still active but no longer used by graduates. Short messages (SMS) were sent to graduates who did not access the online questionnaire. However, this was also limited by inactive phone numbers. The address database mostly consists of mobile phone numbers which were no longer active.

#### 3.3.2.4 Data protection

To assure the security of the data, personal information (e.g. name, telephone number, and email) were stored in different database with the database of their responses. Both databases were connected with the PIN variable.

## 3.4 Data Analysis

Several quantitative data analyses were applied in this study. The general result of the graduate survey was produced from descriptive analysis in SPSS. To reduce the complexity of some data (i.e. graduates' competencies) exploratory factor analysis (EFA) was conducted. confirmatory factor analysis (CFA) was used to provide the proof of validity and reliability of the questionnaire. Multiple regression analysis was used to identify the effects of PBL implementation on graduates' competencies.

The multivariate analysis (i.e. CFA and multiple regressions) was analysed with structural equation models. The analyses were conducted using Amos 20 (Arbuckle, 1999) and R statistical software (with sem package) (Fox, Nie, & Byrnes, 2012).

The next section briefly describes structural equation modelling and the steps taken to conduct it. Afterwards, confirmatory factor analysis (CFA) is explained.

### 3.4.1 Structural equation modelling

In social sciences, including educational and behavioural science, it is common that researchers have to deal with unobserved variables or latent variables. Latent variables cannot be measured directly, however they can be represented or measured by one or more observed variables (indicators) (Hair, Black, Babin, & Anderson, 2010). Observed variables are usually also called manifest variables.

This study comprised some latent variables. For example, PBL implementation consisted of six latent variables. Each latent variable was measured by several items or indicators. The interrelations of PBL's latent variables with other variables (e.g. graduates' competencies) are afterwards hypothesized in this study.

SEM is the most important statistical method for evaluating a series of simultaneous hypotheses about the impacts of latent variables and manifest variables on other variables while taking the measurement errors into account (Lee, 2007).

Hair et al. (2010) stated that structural equation modelling (SEM) is statistical models that seek to explain the relationships among multiple variables. SEM is a combination of factor

analysis, and multiple regression. The main advantage of using SEM is that researcher can include a latent construct/factor.

SEM consists of two models, the *measurement model* and the *structural model* (Brown, 2006; Hair, et al., 2010). The measurement model specifies the number of factors, how the various indicators are related to the latent factors, and the relationship among indicator error (Brown, 2006). In scale development, the measurement model is tested with confirmatory factor analysis (CFA).

The structural model specifies how the various latent factors are related to one another (e.g. direct or indirect effects, no relationship, spurious relationship) (Brown, 2006).

Researchers generally agree that structural equation modelling basically consists of the following steps: defining the individual construct, developing measurement model, model specification, testing the goodness of fit, and model respecification (e.g. Bollen & Long, 1993; Brown, 2006; Hair, et al., 2010; Schumacker & Lomax, 2004).

#### 3.4.1.1 Defining individual constructs

This stage begins with the operationalisation of each construct or factor. The process should be based on a theoretical definition. Based on the operationalisation of the construct, the researcher then develops the items or indicators. The researcher has to carefully select the indicators for a construct because it sets the foundation of the SEM analysis (Brown, 2006).

The operationalisation of individual constructs (for both PBL implementation and graduates' competencies) was presented earlier in section 3.2.2 and 3.2.3 respectively.

Jöreskog (1993) suggests that in the process of analysis, the researcher should test individual construct separately before estimating the measurement model. Therefore in this study each individual construct of the PBL implementation and graduates' competencies was tested separately before testing the structural model.

The researcher could define the relation among indicators and the latent construct purely in path analysis notation, however the interrelations are easier to understand with a visual or path diagram (Hair, et al., 2010). Figure 3.3 depicts an example of an individual construct model. In the model, the latent variable ($\xi_1$) has three indicators (X1, X2, and X3). The paths from the latent variable ($\lambda$) to the indicators depict the effects (regression) of the latent

construct to the observed variables. The deltas (δ) indicate the error variance of the indicators.

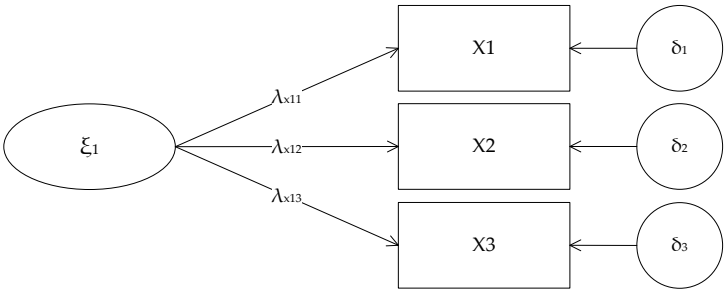



Figure 3.3 Example of individual construct model

### 3.4.1.2 Developing the measurement model

After the indicators for each construct are specified, the next stage is to develop the measurement model. In this stage the researcher must specify three types of relationships: measurement relationships between indicator/items and construct, structural relationship between constructs, and correlational relationships between constructs (Hair, et al., 2010).

This is an important step in the SEM process because the hypotheses test involving the structural relationships among constructs will be no more reliable or valid than is the measurement model (Hair, et al., 2010).

Example of a measurement model can be seen in Figure 3.4. The model consists of two latent constructs ($\xi_1$ and $\xi_2$) each consisted of three indicators. The covariance (correlation) between the latent construct is noted with phi ($\phi$).

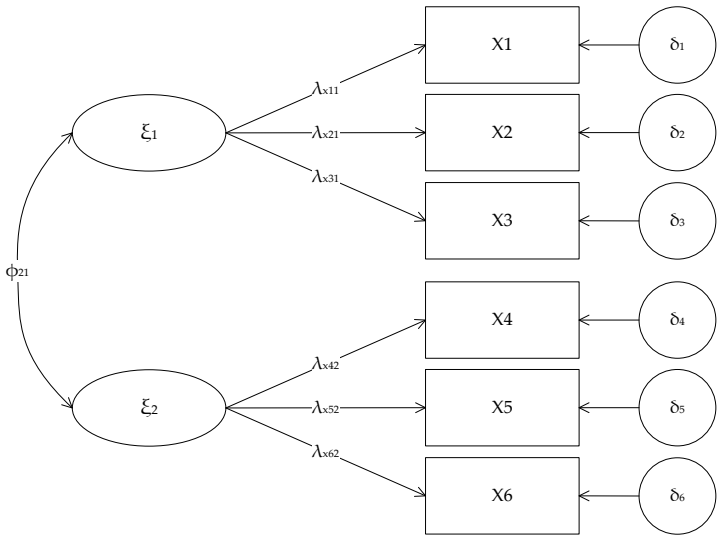



Figure 3.4 Example of measurement model

### 3.4.1.3 Model specification

The model specification includes variables outside the measurement model. In other word, this stage includes one or more variables that are equivalent to a dependent variable. The dependent variable is usually a latent variable which is called endogenous construct.

This stage incorporates the measurement model with a structural model. The researcher should specify the path between the constructs. Figure 3.5 depicts an example of model specification with two exogenous constructs and one endogenous construct. Exogenous can be seen as independent or predictor (causal) variables and endogenous variables as dependent or criterion (outcome) variables (Brown, 2006).

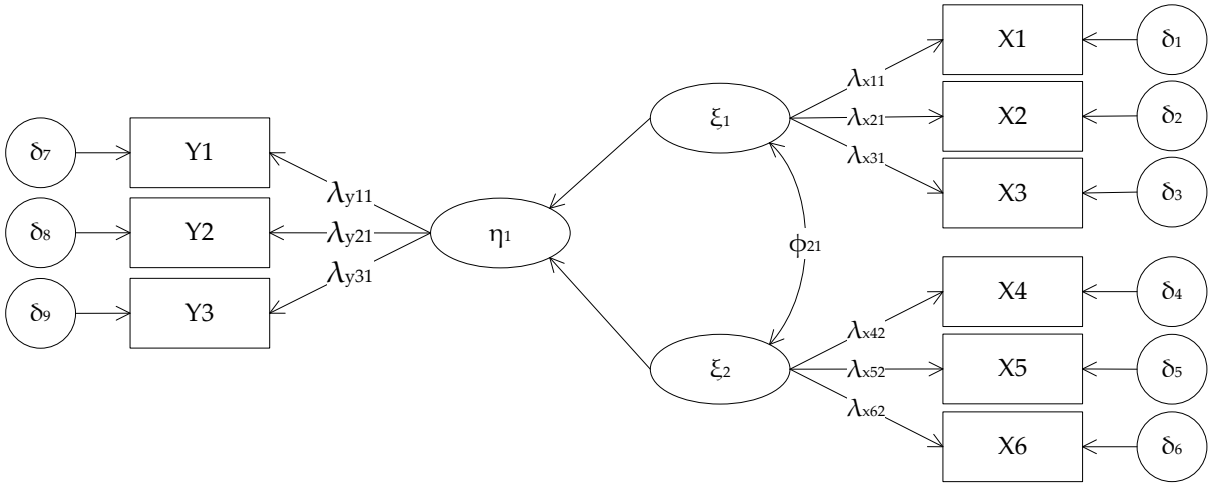
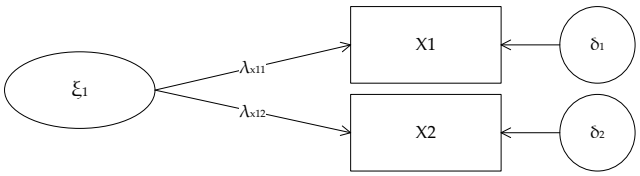



Figure 3.5 Example of structural model

Model specification relates with the model's *degree of identification*. Identification refers to whether there is sufficient information to identify a solution to a set of structural equations (Hair, et al., 2010). The parameter of a model can be estimated only if the number of known information is bigger than the unknown parameter (Brown, 2006). The known information is usually the sample variances and covariances of the indicators. There are three possibilities of model identification: under-identified, just-identified, and over identified.

A model is *under-identified* when the number of known information is less than the number of unknown parameters (Brown, 2006). An illustration of an under-identified model can be seen in Figure 3.6. From the input matrix it can be seen that the model has three known information: two variances ($\sigma_{11}$, $\sigma_{22}$) and one covariance ($\sigma_{21}$). However, the model has four

unknown information ($\lambda_{X11}$, $\lambda_{X21}$, $\delta_1$, $\delta_2$). Thus, this model is under-identified because the number of known information is less than the known information.

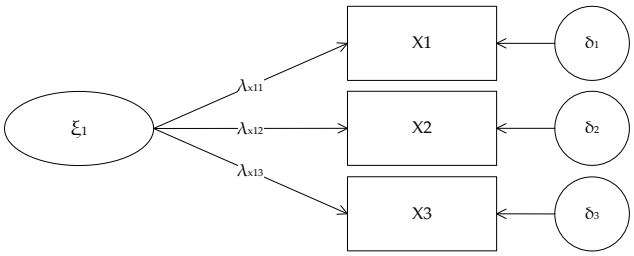



Input matrix

| | X1 | X2 |
|---|---|---|
| X1 | σ11 | |
| X2 | σ21 | σ22 |

Figure 3.6 Example of under-identified model

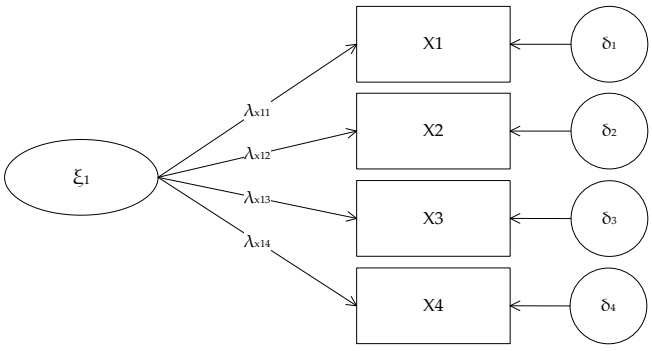
A *just-identified* model is a model with an equal number of known and unknown information (Brown, 2006). The model in Figure 3.7 has six known information: three variances ($\sigma_{11}$, $\sigma_{22}$, $\sigma_{33}$) and three covariances ($\sigma_{21}$, $\sigma_{31}$, $\sigma_{32}$). The model also has six unknown information: $\lambda_{X11}$, $\lambda_{X21}$, $\lambda_{X31}$, $\delta_1$, $\delta_2$, $\delta_3$. Therefore the model is just-identified.




Input matrix

| | X1 | X2 | X3 |
|---|---|---|---|
| X1 | σ11 | | |
| X2 | σ21 | σ22 | |
| X3 | σ31 | σ32 | σ33 |

Figure 3.7 Example of just-identified model




Input matrix

| | X1 | X2 | X3 | X4 |
|---|---|---|---|---|
| X1 | σ11 | | | |
| X2 | σ21 | σ22 | | |
| X3 | σ31 | σ32 | σ33 | |
| X4 | σ41 | σ42 | σ43 | σ44 |

Figure 3.8 Example of over-identified model

A model is *over-identified* when the number of known information exceeds the number of unknown information (Brown, 2006). Figure 3.8 illustrates an over-identified model. The model has 10 known information: four variances ($\sigma_{11}$, $\sigma_{22}$, $\sigma_{33}$, $\sigma_{44}$), and six covariances ($\sigma_{21}$,

$\sigma_{31}$, $\sigma_{41}$, $\sigma_{32}$, $\sigma_{42}$, $\sigma_{43}$). However, it has only eight parameters freely to estimate ($\lambda_{X11}$, $\lambda_{X21}$, $\lambda_{X31}$, $\lambda_{X41}$, $\delta_1$, $\delta_2$, $\delta_3$, $\delta_4$). Therefore, the model is over-identified.

Hair et al. (2010) suggest a minimum of three items per factor, preferably four, in order to provide minimum coverage of the construct and to provide adequate identification for the construct.

#### 3.4.1.4 Testing goodness of fit

The statistical goal of SEM is to test a set of relationships representing multiple equations. It needs a measure of fit or predictive accuracy that reflects the overall model, not a single relationship (Brown, 2006). Therefore, measure of fit for a single relationship (e.g. $R^2$ for multiple regression) is not suitable for SEM (Hair, et al., 2010). Hair et al. (2010) further stated that the fit measure of a model depends on establishing acceptable levels of goodness-of-fit (GOF).

The GOF depicts how well the researcher's theory explains the input data. Model fit is determined by the similarity between the observed covariance matrix and an estimated covariance matrix that results from the proposed model (Hair, et al., 2010).

In other words, Brown (2006) stated that the objective of an SEM model is to produce a predicted variance-covariance matrix ($\Sigma$) that resembles the sample variance-covariance matrix ($S$) as closely as possible. If the researcher's theory were flawless, which rarely happens, the predicted ($\Sigma$) and the sample ($S$) variance-covariance matrices would be the same ($\Sigma=S$).

Chi-square ($\chi^2$), RMSEA, and CFI are the most used fit indices in testing a structural model (Brown, 2006; Hair, et al., 2010). Chi-square is the first fit index to be developed. However, it is rarely used as a single index of fit indices because the value is inflated by sample size (Brown, 2006). In assessing a structural model, the researcher should look for a relatively small $\chi^2$ value and large $p$-value, indicating no statistically significant difference between the observed sample and the SEM estimated covariance matrices (Hair, et al., 2010).

Root mean square error of approximation (RMSEA) is one of the most popular fit indices in the applied literature (Brown, 2006; Hair, et al., 2010). RMSEA is a better fit statistics than $\chi^2$ because the value is robust against the number of variable and sample (Brown, 2006). Brown

(2006) describes RMSEA as: "an 'error of approximation' index because it assesses the extent to which a model fits *reasonably* well in the population (as opposed to testing whether the model holds exactly in the population; cf. $\chi^2$)" (p. 83).

The absolute threshold value of RMSEA is debatable. Even though prior research had pointed to a cut-off value of .05 or .08, there was also a suggestion that pointing an absolute cut-off for RMSEA is inadvisable (Hair, et al., 2010).

The last fit index used in this study is comparative fit indices or CFI. This method compares a proposed model against a baseline model (Brown, 2006; Schumacker & Lomax, 2004). The baseline model is a null or independence model, in which the observed variables are allowed to have variances but are uncorrelated with each other (Hu & Bentler, 1998).

Hair et al. (2010) suggested that it is not necessary to report all GOF indices because they are often redundant. Reporting the $\chi^2$ value and degrees of freedom, the CFI or TLI, and RMSEA will provide sufficient unique information to evaluate a model (Brown, 2006; Hair, et al., 2010). Thus, this study reported $\chi^2$ value and degrees of freedom, CFI, and RMSEA as fit indices of the models.

#### 3.4.1.5 Model re-specification

It is a common practice that researchers try to pursue a good fit in their structural models. The attempt to improve the GOF indices is usually by modifying the tested model. Brown (2006) asserted that in a CFA model the main potential sources of misspecification are the number of factors (too many or too few), the indicators, and the error theory (e.g. uncorrelated vs. correlated measurement error).

Brown (2006) further explained that a misspecification problem from indicators could occur in the following manner: (1) the indicator was specified to load on one factor, but actually has significant loadings on other factors; (2) the indicator was specified to load on the wrong factor; and (3) the indicator was specified to load on a factor, but actually has no salient relationship to any factor.

To increase the model fit or correct the misspecification, the researcher could readjust a structural model based on the result of modification indices. This is conducted by freeing a fixed or constrained parameter with the largest modification indices, as long as the

parameter can be interpreted substantively (Jöreskog, 1993). Hair et al. (2010) added that the desire of a good fit should never compromise the theory being tested.

### 3.4.2 Confirmatory factor analysis

This study involved a specific type of structural modelling called confirmatory factor analysis or CFA. The CFA was conducted to assess the validity and reliability of the PBL implementation questionnaire.

CFA is a type of structural equation modelling that is concerned specifically with measurement models, which is the relationships between observed measures of indicators (e.g. test items, test scores, behavioural observation ratings) and latent variables or factors (Brown, 2006).

CFA is different from its counterpart Exploratory Factor Analysis (EFA), in which the factors are derived from statistical result. CFA is theory-driven, which means that the researcher must start with a theory and then assign specific variables to factors based on the previously defined theory (Hair, et al., 2010). Hair and colleagues (2010) further added that CFA is applied to test the theoretical pattern of factor loading on prespecified constructs representing the actual data. Therefore, CFA is known as an important analytic tool for construct validation in the social and behavioural sciences (Brown, 2006).

The process of CFA is the same as the process of SEM explained in Section 3.4.1. However, in addition to the fitness of the model, the researcher should be concerned also for convergent and discriminant validity (Hair, et al., 2010). The next section discusses this issue.

### 3.4.3 Validity and reliability

#### 3.4.3.1 Construct validity

The main objective of Confirmatory Factor Analysis (CFA) in this study was not only to assure the goodness-of-fit (GOF) of the measurement model, but also to assess the construct validity, especially for the PBL implementation questionnaire. The reason was because measurement model validity depends on (1) establishing acceptable levels of GOF for the measurement model and (2) finding specific evidence of construct validity (Hair, et al., 2010).

Construct validity deals with the accuracy of measurement. It is the extent to which a set of measured items actually reflect the theoretical latent construct those items are designed to measure (Hair, et al., 2010). Hair and colleagues (2010) further suggested that the evidence of construct validity provide assurance that item measures taken from a sample represent the actual true score that exists in the population.

Nunnally (1981) stated that in behavioural science research, construct validity is more appropriate than content and predictive validity. This is particularly true in the term of scale development. Further discussion on this can be found in Nunnally (1981, pp. 94-95).

To assure construct validity, the researcher must provide the evidence of face validity, convergent validity, and discriminant validity (Hair, et al., 2010; Nunnally, 1981).

1. Face validity

Face validity is concerned with the extent to which an instrument appears to measure what it is intended to measure (Nunnally, 1981). Professional judgement process could be used to assess face validity. In the process, experts or professionals judge the validity of the questionnaire. Experts and professional should agree that the items appear to measure a specific construct it is meant to measure. For example, a PBL implementation questionnaire would be said to have face validity if PBL experts or PBL professionals agree with the items used in the questionnaire.

Nunnally (1981) argues that face validity is part of content validity. However, other researchers (e.g. Hair, et al., 2010) argue that face validity also important in establishing construct validity. Hair et al. (2010) further emphasized that: "…in a real way, face validity is the most important validity test" (p. 672).

2. Convergent validity

Convergent validity refers to a condition where the indicators (items) share a high proportion of variance in common (Hair, et al., 2010). There are several ways to ensure the convergent validity:

a. *Factor loading*. High loading on a factor would indicate that they share on a common point (the latent construct). Hair et al. (2010) stated that factor loading should be statistically significant with standardized loading estimate .5 or higher, and ideally

higher than .7. Hair and colleagues further explain the logic behind the value of .6. The squared of a standardized factor loading represent how much variation in an item is explained by the latent factor. A loading of .71 is equal to .5 when squared. This means the factor is explaining half the variation in the item and the other half is error variance. When factor loading falls below .7 means that the error variance share in the item is bigger than the variance from the factor.

b. *Average variance extracted* (AVE). AVE is calculated as the mean variance extracted for the items loading on a construct (Hair, et al., 2010). Standardized loadings are used to calculate its value:

$$AVE = \frac{\sum_{i=1}^{n} \lambda i^2}{n} \quad (3.2)$$

λi = standardized factor loading
i = number of items

c. *Construct reliability*. Zinbarg et al. (2005) suggested that important psychometric property of a scale might be missing when scale-developers and users only report alpha. Furthermore, they concluded that McDonald's omega hierarchical coefficient (ωh) is a better estimate than other reliability estimates (i.e., alpha and beta) (Zinbarg, et al., 2005). Alpha is most appropriately used when the items measure different substantive areas within a single construct, when the set of items measures more than one construct, coefficient omega hierarchical is more appropriate (Zinbarg, et al., 2005). In structural equation modelling, the Omega coefficient is also called construct reliability. Construct reliability is computed from the squared sum of factor loading (λi) for each construct and the sum of the error variance terms for a construct (*ei*) (Hair, et al., 2010).

$$CR = \frac{(\sum_{i=1}^{n} \lambda i)^2}{(\sum_{i=1}^{n} \lambda i)^2 + (\sum_{i=1}^{n} ei)} \quad (3.3)$$

Hair et al. (2010) suggested that construct reliability value of .7 assures a good reliability. High construct reliability means that internal consistency is present (Blunch, 2008), this means that the items consistently represent the same latent construct.

3. Discriminant validity

The second component of construct validity is discriminant validity. It is the extent to which a construct is truly distinct from other constructs (Hair, et al., 2010). Therefore, high

discriminant validity provides a proof that a construct is distinct. It measures a unique phenomenon that is not measured by another construct.

A rigorous way to test the construct validity of a measurement is to compare the average variance-extracted (AVE) values for any two constructs with the squared interconstruct correlation (Fornell & Larcker, 1981; Hair, et al., 2010). The AVEs should be greater than the squared intercorrelation (Fornell & Larcker, 1981; Hair, et al., 2010). This is based on the idea that a latent construct should share more variance in its items than it shares with another construct. Surpassing this assessment provides a good evidence of discriminant validity (Hair, et al., 2010).

In statistical computing, instead of comparing the AVE with the corresponding squared correlation one by one, the researcher could use the Average shared squared variance or ASV. ASV is calculated by averaging the squared correlation of the corresponding factors. ASV is calculated with the following formula:

$$ASV = \frac{\sum_{i=1}^{n} \gamma i^2}{n-1} \quad (3.4)$$

$\gamma$i = interconstruct correlation
i = number of corresponding constructs (total constructs-1)

Using the ASV, discriminant validity can be achieved when AVE > ASV. Chapter 5 discusses more in depth the application of AVE and ASV in assessing discriminant validity of a measurement model (see Section 5.1.7.2).

#### 3.4.3.2 Goodness-of-fit threshold

Fit indices are affected by various analytic situations such as sample size, model complexity, estimation method, amount and type of misspecification, normality of data, and type of data (Brown, 2006). Therefore, there are different opinions regarding the cut-off criteria to indicate a good or poor model fit.

Browne and Cudeck (1993) propose a rule of thumb that RMSEA values should be less than .08 to indicate a good fit model. Hu and Bentler (1999) proposed more restricted cut-off value: RMSEA should close or below .06.

Researchers have noted that CFI values greater than .90 are usually regarded as a fit model (Bentler, 1990; Marsh, 1994). Although newer studies suggested CFI values close or higher than .95 support a good fit model (Hu & Bentler, 1999).

This study used the threshold of fit indices by Hair et al. (2010). Hair et al. (2010) proposed a more refined threshold for assessing a structural model. The threshold criteria include the number of observations and the number of observed variables in deciding the cut-off values of the model fit. Table 3.15 shows the complete fit indices threshold proposed by Hair et al. (2010).

Table 3.14
Fit indices across different model situations

| | *N* < 250 | | | *N* >250 | | |
|---|---|---|---|---|---|---|
| GOF | *m* ≤ 12 | 12 < *m* <30 | *m* ≥ 30 | *m* ≤ 12 | 12 < *m* <30 | *m* ≥ 30 |
| $\chi^2$ | Insignificant p-values expected | Significant p-values even with good fit | Significant p-values expected | Insignificant p-values even with goodfit | Significant p-values expected | Significant p-values expected |
| CFI or TLI | .97 or better | .95 or better | Above .92 | .95 or better | Above .92 | Above .90 |
| RNI | May not diagnose misspecification well | .95 or better | Above .92 | .95 or better, not used with N > 1,000 | Above .92, not used with N > 1,000 | Above .90, not used with N > 1,000 |
| SRMR | Biased upward, use other indices | .08 or less (with CFI or .95 or higher) | Less than .09 (with CFI above .92) | Biased upward, use other indices | .08 or less (with CFI above .92) | .08 or less (with CFI above .92) |
| RMSEA | Values < .08 with CFI = .97 or higher | Values < .08 with CFI of .95 or higher | Values < .08 with CFI above .92 | Values < .07 with CFI of .97 or higher | Values < .07 with CFI of .92 or higher | Values < .07 with CFI of .90 or higher |

*Note*. Source Hair et al. (2010, p. 654). *m* = number of observed variables; *N* = number of observations per group when applying CFA to multiple groups at the same time.

## 3.5 Summary

This chapter provided the explanation of the methods used in this study. Information such as the medical education in Indonesia, characteristics of the subject, preparation of the survey and field phase process were presented in this chapter. Table 3.15 provides the summary of the graduate survey conducted in this study.

This chapter also elaborated the theoretical background of instrument development. The PBL questionnaire was developed based on theoretical notions underlying PBL components. The selection of the items also took into account the opinions of: PBL experts, quantitative methodological experts, and medicine graduates.

Graduates' competencies indicators used in the present study were based on prior research mainly from a research project with a collaboration of experts from 12 countries (i.e. CHEERS). The selection of the indicators was based also on the preliminary analysis and the accordance with graduates' competencies used in medical education research.

Table 3.15
Survey metadata

| | |
|---|---|
| Survey name | Graduate survey for medicine graduates - Gradmedic |
| Purposes | Main objectives were:<br>• to develop a questionnaire to evaluate PBL implementation<br>• to identify each phase of PBL curriculum<br>• to investigate the effect of PBL on graduates' competencies |
| Field phase | March 15th - May 31st, 2012 |
| Time dimension | Cross-sectional survey |
| Target population | Graduates of Medicine Faculty, Gadjah Mada University, graduated between February 2009 and July 2011. |
| Sampling frame | Email and telephone list |
| Total respondent | 225 |
| Response rate | 39.1 % |
| Languages | Bahasa Indonesia and English |
| Mode of administration | Online questionnaire and by-request paper-questionnaire |
| Web site | http://www.gradmedic.com |

The theory driven process of questionnaire development elaborated in this study provided a solid base for further statistical analysis, especially in conducting confirmatory factor analysis. As mentioned before, the fundamental feature of confirmatory factor analysis lies on its theoretical-drive nature.

A general overview of structural equation modelling and confirmatory analysis was also included in this chapter to provide the background for more detailed discussion in the subsequent chapters.

The next chapter presents the result of descriptive statistics of the graduate survey conducted in the Faculty of Medicine, Gadjah Mada University.

# 4 Descriptive statistics analysis

This chapter elaborates the results of a graduate survey conducted in the Faculty of Medicine, Gadjah Mada University (UGM). The descriptive statistics of the survey's result will be presented in sections according to the corresponding themes.

## 4.1 Socio-biographic background

As stated before in the method chapter, the participants of the survey were graduates who graduated between February 2009 and July 2011. From all graduates (*N*=225) who responded to the questionnaire, 56.1% were female and 43.9% were male. Graduates were mostly from the regular program (86.1%), only some of them were from the international program (13.9%).

The cohort composition was mainly dominated by graduates from the cohort of 2005, 2004, and 2003 (44%, 29% and 18% respectively). Less than 10% of graduates were from the cohort of 2002 and before.

Most of the graduates (88%) had completed secondary education in Indonesia, only a few of them had secondary education abroad (12%). Almost all graduates who had secondary education abroad attended the international medicine program in UGM. Most of them came from the neighbour countries, i.e. Malaysia, Myanmar, and Cambodia.

Graduates with Indonesian nationality came from different cities in Indonesia. Their origin was reflected in the location of their high school. Most of the graduates came from the province of Yogyakarta (39%) where UGM is located, and the nearest province, middle-Java province (19%).

Graduates' average age at the time of the survey was 26.3 years old (*SD* = 2.27, *M* = 26). With regard to marital status, the majority of the graduates were still single (64%) and only about one third were married (36%). More than half of the married graduates (56.3%) had children living in their household.

Around two third of the graduates (62.7%) reported to have parents with bachelor degrees or higher. This number confirms the presupposition that students whose parents have a higher education degree are more likely to be enrolled in higher education, despite the efforts to increase equality of opportunity (WZ1, 2000).

As expected, students of the medicine faculty are comprised of high achieving individuals (Norman & Schmidt, 2000). The majority of graduates (87%) reported that they had high or very high grades in secondary education.

## 4.2 Course of study and study activities

### 4.2.1 Study condition

Graduates were asked to rate the study provision and condition they had experienced during their course of study. The rating was ranging from 1 "Very bad" to 5 "Very good". Graduates from all cohorts generally had the same perspective on the study condition. The data indicated the same trend that the study provision and conditions were getting better in each cohort. For example, only about two thirds of graduates (62%) matriculated in 2002-and-before rated their campus as having adequate *course content* for studying medicine (Table 4.1). The value increased gradually in 2003 (76%), 2004 (83%) to 2005 (92%). The same trend was found in *expert advice*, *laboratories*, *quality of technical equipment*, and *chances to participate in research projects*. The other indicators of study provision and condition showed similar trends with minor variation on the ratings.

One exception was found in *practical emphasis of teaching and learning* where the highest rating was found in cohort 2003 (68%) followed by 2004 (58%), 2005 (52%) and 2002-and-before (48%). This could be explained by UGM's implementation of full PBL method in 2003. As stated in Chapter 2, PBL has certain characteristics which enable students to experience real medical practice condition. PBL uses problems as stimulus for learning and the problems

should reflect on real-world condition. Barrows (1996) stated that the problems in PBL represent the challenges students will face in practice and provides the relevance and motivation for learning. Thus, the problem format has to present patient problems in the real-world (Barrows, 1996). This approach would give students the opportunity to experience medical practice conditions as close as possible in their study condition.

Table 4.1
Study provision and condition in FK UGM (percent; responses 4 and 5*)

| | 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|
| Course content of major | 62 | 76 | 83 | 92 | 84 |
| Assistance/advice for your final examination | 71 | 92 | 80 | 84 | 83 |
| Equipment and stocking of libraries | 81 | 87 | 82 | 84 | 83 |
| Supply of teaching material | 57 | 79 | 81 | 79 | 78 |
| Laboratories | 55 | 76 | 81 | 82 | 78 |
| Contacts with fellow students | 52 | 76 | 80 | 78 | 76 |
| Quality of technical equipment (e.g. workstations, wlan, internet, measuring instruments, etc.) | 52 | 71 | 73 | 78 | 73 |
| Variety of courses offered | 57 | 74 | 72 | 75 | 72 |
| Teaching quality | 48 | 71 | 67 | 74 | 69 |
| Design of degree program | 57 | 63 | 68 | 55 | 60 |
| Chances to participate in research projects | 48 | 50 | 59 | 62 | 58 |
| Testing/grading system | 43 | 55 | 65 | 56 | 57 |
| Practical emphasis of teaching and learning | 48 | 68 | 58 | 52 | 56 |
| Expert advice | 29 | 44 | 52 | 57 | 50 |
| Academic advice offered in general | 29 | 50 | 47 | 44 | 44 |
| Research emphasis of teaching and learning | 38 | 45 | 49 | 42 | 44 |
| Opportunity of out-of-class contacts with teaching staff | 29 | 37 | 35 | 35 | 35 |
| Opportunity to choose courses and areas of specialisation | 30 | 34 | 33 | 31 | 32 |
| Provision of work placements and other work experience | 29 | 29 | 37 | 30 | 31 |
| Chance for students to have an impact on university policies | 19 | 18 | 15 | 14 | 16 |
| Count | 21 | 38 | 60 | 97 | 216 |

*Note*. Question B9: How do you rate the study provision and study conditions you experienced in the course of study? (Please rate only your experience in undergraduate study). *Responses 4 and 5 on a scale of answers from 1 "Very bad" to 5 "Very good".

One might question however, why after the 2003 cohort the percentage was decreasing. Graduates' rating on practical emphasis of teaching and learning was indeed decreasing after 2003, however the result of the Kruskal-Wallis test asserted that the difference was not significant, $\chi^2$ (2, $N$ = 193) = 3.66, $p$ = ns. Similar findings in which the 2003 cohort has higher rating than other cohorts could be found in *academic advice offered in general*, *assistance/advice for final examination*, *opportunity of out-of-class contacts with teaching staff*, and *equipment and stocking of libraries*.

Another exception is in *chance for students to have an impact on university policies* in which the highest rating was found in the cohort of 2002 and before (19%). The value of the rating was not only the lowest among other indicators of study provision and condition, but also decreased in the following cohorts (14% in 2005 cohort). However, the decrease in each cohort was not significant based on the Kruskal-Wallis test $\chi^2$ (3, $N$ = 213) = 3.30, $p$ = ns. This result is not atypical since students rarely feel that they have a chance to influence university policies. This result is similar with the findings of the CHEERS projects in which only 16% of graduates from 13 countries stated that they have a chance to have an impact on university policies (WZ1, 2000).

Graduates were also asked to rate the advisory and guidance indicators in their study course (Table 4.2). More than half of the graduates reported that the teaching staff gave a good or very good *professional advice and guidance*. However, only 20% of graduates stated that they had enough *individual occupational advice* during their study. Moreover, the number dropped to only 9% in the 2003 cohort. One possible explanation is because of the implementation of the full PBL approach in 2003. The teaching staffs were occupied with the process and as a consequence had less time for individual advice for students.

Table 4.2
Advisory and guidance in FK UGM by cohort (percent; responses 4 and 5*)

| | ≤ 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|
| Professional advice and guidance provided by teaching staff | 30 | 52 | 60 | 63 | 57 |
| Discussion of written examinations, assignments etc. | 15 | 21 | 26 | 24 | 23 |
| Individual occupational advice in your field | 20 | 9 | 19 | 23 | 20 |
| Individual study advice in your field | 16 | 15 | 22 | 28 | 23 |
| Count | 20 | 33 | 58 | 99 | 210 |

*Note.* Question B11: How do you rate the following advisory and guidance elements in your study course? *Responses 4 and 5 on a scale of answers from 1 "Very bad" to 5 "Very good".

### 4.2.2 PBL implementation

Graduates were asked to rate the condition in the study course based on the division of PBL components or factors. The rating ranged from 1 "Not at all" to 5 "To a very high extent". The six components of PBL (Student-centred learning, Small group, Problem as stimulus, Real-

world problems, Teacher as facilitator, and Self-directed learning) and their indicators have already been described in Chapter 3 Section 3.2.2.

Table 4.3 depicts graduates' rating on PBL components. Among all indicators of PBL components, the lowest ratings were mostly found in Teacher as facilitator. For example, only 34% of graduates consider that their tutors have a clear picture about their role as a tutor. Graduates also think that their tutor should be more motivated to serve their role (39%) and encourage students to evaluate group cooperation more regularly (39%). Additionally, the tutors should also encourage the students to summarize what they have learnt in their own words more frequently (40%). The fact that Teacher as facilitator has the lowest rating among other PBL components should be noted by Gadjah Mada University (UGM) for further improvement in PBL tutorial process.

Other low ratings were found in Student-centred learning (SCL) factor in which graduates reported that there should be more equal role between teacher and student (42%). In the Self-directed learning component, graduates reported that students should be more intense in assessing their own learning outcome (43%).

Conversely, the highest ratings were found in Small group and SCL factor. More than three quarters of graduates (78%) reported that they experienced learning processes in a small group which graduates found to be stimulated the group discussion (75%). With regard to the SCL factor, graduates reported that in their study course, students were responsible for their own learning (74%) and were actively involved in the process of learning (73%).

Table 4.3
Implementation of PBL (percent; responses 4 and 5*)

| | Total |
|---|---|
| Student-centred learning | |
| Students are responsible for their own learning | 74 |
| Students are actively involved in the process of learning | 73 |
| Teacher is not the main source of information | 70 |
| Students have autonomy in the process of learning | 67 |
| Emphasis on deep learning | 46 |
| Equal role of teacher and students (interdependence) | 42 |
| Small group | |
| Learning process occurs in a small group (5-9 students). | 78 |
| The group size is appropriate to stimulate group discussion | 75 |
| The group size is appropriate to encourage active student participation | 71 |
| The learning groups have positive atmosphere (non-threatening) | 66 |
| Problem as stimulus | |
| The problems in the tutorial process… | |
| …stimulate thinking, analysis, and reasoning | 71 |
| …match with students' level of knowledge | 67 |
| …arouse students' curiosity | 67 |
| …activate students' prior knowledge | 66 |
| …assure self-directed learning | 64 |
| …lead to the discovery of the learning objectives | 60 |
| …use appropriate vocabulary | 57 |
| Real-world problem | |
| The problems in the tutorial process… | |
| …are clinically relevant | 69 |
| …are realistic | 66 |
| …related to a public health topic | 64 |
| …generate multiple hypotheses about their cause and solution | 64 |
| Teacher as facilitator | |
| The tutors stimulate the students | |
| …to apply knowledge to the discussed problem | 62 |
| …to understand underlying mechanisms/theories | 59 |
| …to search for links between issues discussed in the tutorial group | 52 |
| …to apply knowledge to other situations/problems | 52 |
| …to give constructive feedback about the group work | 49 |
| …to summarize what they had learnt in their own words | 40 |
| The tutors are clearly motivated to fulfill their role as a tutor | 39 |
| The tutors stimulate the students to evaluate group co-operation regularly | 39 |
| The tutors have a clear picture about their strengths/weaknesses as a tutor | 34 |

(Table 4.3 continues)

(Table 4.3 continued)

| | Total |
|---|---|
| Self-directed learning | |
| Students decide the resources (human and material) for learning | 68 |
| Students choose appropriate learning strategies | 58 |
| Students take initiative in diagnosing their learning needs | 56 |
| Students formulating the learning goals | 51 |
| Students evaluate the accuracy and value of the resources | 51 |
| Students self-monitor their learning progress | 50 |
| Students self-assess their learning outcome | 43 |
| Count | 209 |

*Note.* Question B14: To what extent were the following statements matches with the conditions in your study course? *Responses 4 and 5 on a scale of answers from 1 "Not at all" to 5 " To a very high extent ".

To provide a broader view of PBL implementation, graduates responses were aggregated based on the PBL components. This was achieved with an item parcelling procedure. Item parcelling refers to summing or averaging together two or more items and using the result as the basic unit of analysis (Cattell, 1956). Each factor variable was created by averaging all indicators which belong to the specific factor. For example, the new factor variable for student-centred learning (SCL) was created by averaging graduates' responses in SCL indicators (see Table 3.5 for the complete indicators of SCL). The same procedure was conducted for the others PBL components.

Table 4.4 depicts the arithmetic mean of each PBL implementation component by cohort. The results projected a similar trend when indicators of PBL implementation were reviewed individually (Table 4.3). Graduates reported the lowest rating in Teacher as facilitator ($M$ = 3.37; $Mdn$ = 3.44; $SD$ = .63) and Self-directed learning ($M$ = 3.44; $Mdn$ = 3.57; $SD$ = .74), while the highest found in Small group ($M$ = 3.82; $Mdn$ = 4; $SD$ = .62).

The categorisation by cohort generally showed a similar tendency that the graduates' rating was increasing from one cohort to the next one. This indicates that implementation of PBL in Gadjah Mada University was getting better in each cohort. It should be pointed out also that there is a similar pattern in which graduates ratings increase rapidly from 2002-and-before to 2003 followed by steady or slightly increased values in the following year. One exception was found in *Teacher as facilitator* where the values increase steadily in each cohort. The rapid increase of graduates rating in 2003, as stated before, could be explained by the

implementation of full-PBL method in 2003. Nevertheless, the difference by cohort in each PBL component is not significant based on the Kruskal-Wallis test.

Table 4.4
Implementation of PBL (arithmetic mean)

| | ≤ 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|
| Student-centred learning | 3.4 | 3.7 | 3.5 | 3.7 | 3.6 |
| Problem as stimulus | 3.4 | 3.8 | 3.7 | 3.7 | 3.7 |
| Real Problem | 3.6 | 4.0 | 3.6 | 3.7 | 3.7 |
| Teacher as facilitator | 3.1 | 3.2 | 3.4 | 3.5 | 3.4 |
| Self-directed learning | 3.0 | 3.5 | 3.5 | 3.5 | 3.4 |
| Small group | 3.6 | 4.0 | 3.8 | 3.8 | 3.8 |
| Count | 19 | 33 | 58 | 99 | 209 |

*Note.* Question B14: To what extent were the following statements matches with the conditions in your study course? Scale of answers was from 1 "Not at all" to 5 " To a very high extent ".

Table 4.5 presents the means of satisfaction with PBL implementation divided by cohort. Overall, when asked about their satisfaction with PBL implementation, 44% of graduates reported being satisfied or very satisfied.

Table 4.5
Satisfaction with PBL implementation (percent and arithmetic mean)

| | ≤ 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|
| 1 Very dissatisfied | 0 | 6 | 2 | 1 | 2 |
| 2 | 15 | 13 | 12 | 14 | 13 |
| 3 | 46 | 38 | 35 | 45 | 41 |
| 4 | 31 | 41 | 49 | 40 | 42 |
| 5 Very satisfied | 8 | 3 | 2 | 0 | 2 |
| Total | 100 | 100 | 100 | 100 | 100 |
| Count | 13 | 32 | 57 | 95 | 197 |
| Recoded values | | | | | |
| 1 and 2 | 15 | 19 | 14 | 15 | 15 |
| 3 | 46 | 38 | 35 | 45 | 41 |
| 4 and 5 | 38 | 44 | 51 | 40 | 44 |
| Arithmetic mean | 3.3 | 3.2 | 3.4 | 3.2 | 3.3 |

*Note.* Question B13: Generally how satisfied are you with the implementation of PBL curriculum? Scale of answers was from 1 " Very dissatisfied" to 5 "Very satisfied".

Only 15% of graduates were *very dissatisfied* and 41% were in the middle of the rating. There are minor satisfaction variations with regard to cohort and the result of the Kruskal-Wallis test showed that the difference in satisfaction between cohorts is not significant ($\chi^2$ (3, $N$ = 200) = 1.85; $p$ = ns.).

## 4.3 Job search and sequence of professional activities

### 4.3.1 Job search

Questions about job seeking is important because graduates might be less successful than they could be (compared to their competencies) because the process of transition from study to employment was worse than is customary (Teichler & Schomburg, 2013). Therefore, a smooth transition to employment is one of the indicators of career success (Teichler, 1999). Smooth transition here might include: short periods and limited effort for job search, short intervals between graduation and employment, and minimum periods of occasional employment while searching for regular employment (Teichler, 1999).

The common belief is that medicine graduates will find employment easily because of the demand for such a profession is high. The survey data depicted that, on average, graduates need two months of job search period (*Mdn* = 1). It should be noted also that not all graduates seek a job. Most graduates, who were not seeking employment, found a job without searching (16%), some were continuing with master degree (3%) and some became self employed (1%) (Table 4.6).

Table 4.6
Seeking a job after graduation (percent)

| | Female | Male | Total |
|---|---|---|---|
| Yes, in medical and health sector | 80 | 78 | 79 |
| Yes, not in medical and health sector | 2 | 0 | 1 |
| No, I continued studying to master degree | 3 | 3 | 3 |
| No, I found a job without searching | 15 | 16 | 16 |
| No, I became self-employed | 0 | 2 | 1 |
| Total | 100 | 100 | 100 |
| Count | 111 | 91 | 202 |

*Note.* Question C1: Did you ever seek a job since graduation? Please exclude temporary non study related job.

Table 4.7 depicts the method used by graduates for seeking employment. Almost two thirds of graduates (63%) used personal connections or contacts (e.g. parents, relatives, friends) as a mode of job seeking. Almost one quarter of graduates (23%) had even already established contacts during their course of study with future employment in mind. Other common methods used by graduates in seeking employment were: contacting employers without knowing about a vacancy (30%) and applied for advertised vacancy (25%). Besides seeking

employment, about one fifth of graduates (20%) stated that they were approached by an employer.

Table 4.7
Method of job seeking (percent; multiple responses)

| | Female | Male | Total |
|---|---|---|---|
| I used other personal connections/contacts (e.g. parents, relatives, friends) | 59 | 67 | 63 |
| I contacted employers without knowing about a vacancy | 38 | 21 | 30 |
| I applied for an advertised vacancy | 28 | 22 | 25 |
| I established contacts while working during the course of study | 20 | 27 | 23 |
| I was approached by an employer | 24 | 15 | 20 |
| Government's program for new doctors | 9 | 16 | 12 |
| I enlisted the help of teaching staff of the institution of higher education | 10 | 8 | 9 |
| I started my own business/self-employment | 5 | 8 | 7 |
| I contacted a public employment agency | 2 | 1 | 2 |
| I contacted a commercial employment agency | 1 | 1 | 1 |
| I enlisted the help of the careers/placement office of my institution of higher education | 1 | 0 | 1 |
| Count | 93 | 73 | 166 |

*Note.* Question C2: How did you look for a job after graduation? Multiple replies possible

The pattern holds the same when graduates were asked about the most important method for finding their job (see Table 4.8). Using personal contacts (42%) and contacts established during study (14%) were the most thriving method. In contrast, job search by contacting employers without knowing about a vacancy was the least successful method. Although used by 30% of graduates this method only successful for 9% of them. The same condition was found in the job search method of applying for an advertised vacancy which was used by 25% of graduates but only decisive for 9% of them.

The fact that personal connections or contacts are the most used job search method showed a distinct characteristic of the medical field in Indonesia. When asked the same question, graduates from Europe and Japan (in CHEERS, Careers after Higher Education: a European Research Study) generally stated that sending applications to employers was the most prevalent method in getting a job (WZ1, 2000).

Table 4.8
The most important method for getting a job (percent)

| | Female | Male | Total |
|---|---|---|---|
| I used other personal connections/contacts (e.g. parents, relatives, friends) | 41 | 42 | 42 |
| I established contacts while working during the course of study | 13 | 17 | 14 |
| Government's program for new doctors | 11 | 17 | 14 |
| I applied for an advertised vacancy | 9 | 8 | 9 |
| I contacted employers without knowing about a vacancy | 14 | 4 | 9 |
| I was approached by an employer | 6 | 1 | 4 |
| I enlisted the help of the careers/placement office of my institution of higher education | 2 | 4 | 3 |
| I enlisted the help of teaching staff of the institution of higher education | 2 | 4 | 3 |
| I contacted a public employment agency | 1 | 0 | 1 |
| I started my own business/self-employment | 1 | 1 | 1 |
| Total | 100 | 100 | 100 |
| Count | 88 | 71 | 159 |

*Note.* Question C3: Which method was the most important one for you to get a job after graduation? Please fill in the item number from question C2

The use of personal contacts or connections in getting a job is common in medicine since the profession has a long tradition of intergeneration transfer of occupations. Children who have doctor parents have been following their parents into medicine. Lentz and Laband (1989) asserted that doctors pass along valuable human capital to their children to motivate them to attempt to become doctors, and better prepare them to be successful in applying and completing medical school. However, Lentz and Laband (1989) also pointed out that there are evidences of favouritism and nepotism in medical school admission. Children of doctors are nearly 14% more likely to be admitted into medical school than are other children (Lentz & Laband, 1989). The data of job search method in the present study inferred that personal relations not only helps students admitted to medical school, as noted by Lentz & Laband (1989), but also helped them in getting a job as a medical doctor.

Another condition that should be noted is that few graduates (14%) stated that they registered in governmental programs for new medical doctors. In this kind of program graduates work in hospitals appointed by the government (mostly located in rural area) for a designated time. Graduates with Malaysian nationality stated that this kind of program is compulsory in Malaysia. While in Indonesia, such a program exists but it is no longer compulsory. Conceivably because of the possibility to be working in a rural area, this method of job seeking is less attractive to female graduates (9% female versus 16% male).

Table 4.9
The Importance of recruitment criteria (percent; responses 4 and 5*)

| | Female | Male | Total |
|---|---|---|---|
| Reputation of the institution of higher education | 94 | 93 | 93 |
| Field of study | 93 | 92 | 92 |
| Personality | 91 | 90 | 91 |
| Practical/work experience acquired during course of study | 78 | 81 | 79 |
| Main subject/specialisation | 69 | 79 | 73 |
| English proficiency | 67 | 77 | 71 |
| GPA | 65 | 48 | 58 |
| Recommendations/references from third persons | 55 | 61 | 57 |
| Computer skills | 47 | 60 | 53 |
| Other foreign language proficiency | 27 | 24 | 26 |
| Experience abroad | 18 | 18 | 18 |
| Count | 95 | 73 | 168 |

*Note.* Question C6: How important, according to your perception, were the following aspects for your employer in recruiting you for your employment after graduation, if applicable? *Responses 4 and 5 on a scale answers from 1 "Not at all important" to 5 "Very important".

Table 4.9 asserts graduates rating of employers' consideration in recruiting graduates. Graduates reported three aspects more frequently than other aspects which were important for their employers when recruited them. Those aspects were: field of study (92%), reputation of the institution of higher education (93%), and personality (91%). The emphasis on *field of study* was expected in a professional field like medicine because one should have finished the training as doctor to be able to work as physician. The high frequency in the *reputation of the institution of higher education* seems to reflect the steep hierarchy among higher education institutions in Indonesia. Gadjah Mada University, where the graduates of the present study finished their education, is one of the oldest and finest higher education institutions in Indonesia. Therefore it is natural that graduates feel that employers are taking account the reputation of their alma mater in the recruitment process.

In addition, about three quarters of graduates mentioned that practical or work experience acquired during course of study (79%), English proficiency (71%), and main subject or specialisation (73%) were important. The least important aspects were found in experience abroad (18%) and other foreign language proficiency (26%).

### 4.3.2 Sequence of professional activities

Graduates were asked to describe their predominant activities since graduating with bachelor degree in medicine. Almost two thirds of the graduates stated that they have more than one activity. Table 4.10 depicts that all graduates have already finished clinical rotation. About one third of graduates were employed or self-employed.

Table 4.10
Activities since graduated with bachelor degree in medicine (percent; multiple responses)

| | Female | Male | Total |
|---|---|---|---|
| Clinical rotation | 100 | 100 | 100 |
| Employment / Self-employment | 34 | 41 | 37 |
| Post graduate studies (Master degree) | 11 | 5 | 8 |
| Other activity after graduation | 8 | 7 | 8 |
| Specialisation program | 3 | 7 | 5 |
| Parental leave | 6 | 0 | 3 |
| Doctorate | 1 | 1 | 1 |
| Unemployment | 2 | 1 | 1 |
| Count | 122 | 103 | 225 |

*Note.* Question C7: Please summarize your predominant activities since you got bachelor degree in medicine (BMed/S.Ked). Multiple answers possible.

Only few of the graduates continued with further education and training. Less than one tenth of the graduates continued to master degree (8%). Female graduates seem more attracted to continue to master degrees than their male colleagues (11% versus 5%). Very few started a medical specialisation program (5%) or doctorate program (1%). This is understandable since on average the graduates were 3.23 years out from graduation with a Bachelor in Medicine when the survey was conducted ($SD$ = 1.486, $M$ = 3.00).

## 4.4 Current activities, employment and work

When the survey was conducted more than three quarters of graduates (81%) were employed or self-employed while 19% were unemployed (Table 4.11). The unemployment rate is considered high especially for medicine. However, most of the unemployed graduates (43%) had been working previously and for various reasons were unemployed when the survey was conducted. Other reasons for unemployment include: continuing to a master program (22%), taking a specialisation program (17%), training programs (14%), and parental leave (2%).

Table 4.11
Employment by gender (percent)

| | Female | Male | Total |
|---|---|---|---|
| Yes, I am employed | 77 | 75 | 76 |
| Yes, I am self-employed | 2 | 9 | 5 |
| No | 22 | 16 | 19 |
| Total | 100 | 100 | 100 |
| Count | 115 | 91 | 206 |

*Note*. Question D1: Are you currently employed/self-employed?

Most of the graduates work in Indonesia (82%), only 18% work abroad. This condition is related to graduates' origin. After finishing the international program most graduates returned to their home countries and found employment there. In Indonesia graduates were mostly working in Java, the most populated island. They were mostly working in Yogyakarta province (41%) where UGM is located, the capital Jakarta (13%), and Middle Java province (11%). This shows that graduates have a low mobility after graduation. On one hand this shows that graduates can compete in the local employment market. On the other hand, it is also a poignant reflection of the unequal distribution of physicians in Indonesia, despite the efforts of the government to encourage new physicians to work outside Java Island. Indonesia is an archipelago consisting of thousands of islands. In some islands it is difficult to find a physician; citizens have to go to other islands before they can have medical service from physician.

Furthermore, UGM is one of few public universities in Indonesia with a medical faculty. The Indonesian higher education system is mostly supported by private universities. The 2010 data from the Directorate General of Higher Education Indonesia show that there are only 83 (2.7%) public higher education institutions, while the private ones reach 2,987 (97.3%). Higher education institutions in Indonesia are highly hierarchical and generally public universities have higher quality than the private ones. UGM is one of the best universities in Indonesia that is deemed to produce highly competent physicians. Therefore it is regrettable that highly competent physicians are only located in Java's big cities while other rural areas are also in need of them.

As stated before, the survey was conducted eight months to three years after graduation (awarded the title Medical Doctor). Therefore, graduates were still in their early career period. This is also shown by the percentage of graduates in temporary contract work. Half

of employed graduates (50%) reported that they were working under a temporary contract while 43% were under permanent contract.

Minor variations in regards to gender are shown in Table 4.11. More female graduates (22%) are unemployed than their male colleagues (16%). Female graduates (56%) also reported that they are more likely than males (41%) to work under temporary contract (Table 4.12). This is a general circumstance where graduates are in the phase of life when they decide to settle down, get married and have children. Unfortunately the phase most of the time is disadvantageous for women because they usually have more responsibility in child rearing, especially when the children are still small. The marital status of graduates supports this explanation; more female graduates (42%) are married as compared to male graduates (28%).

Table 4.12
Type of contract (percent)

| | Female | Male | Total |
|---|---|---|---|
| Temporary | 56 | 41 | 50 |
| Permanent | 40 | 48 | 43 |
| Other | 4 | 11 | 7 |
| Total | 100 | 100 | 100 |
| Count | 85 | 63 | 148 |

*Note*. Question D2: What type of contract do you have in your current job?

Graduates were also asked about their working environment (Table 4.13). The top two working environments are medical practice and regional hospital. Forty two percent of graduates reported that they were working in medical practice while one fifth (21%) were working in regional hospital. The next prevalent working environments were university (9%), university hospital (8%), and medical practice in private sector (e.g. company doctor) (8%). Gender plays a role in the preference of working environment. Male graduates were more likely to work as a company physician (11%) than their female colleagues (6%). Among other things, this is due to the harsh working condition in some companies (e.g. physicians in oil companies have to work in offshore oil rig). On the other hand, the percentage of females working in universities was double that of male graduates (Table 4.13).

Table 4.13
Working environment (percent)

| | Female | Male | Total |
|---|---|---|---|
| Medical practice | 42 | 41 | 42 |
| Regional hospital | 16 | 25 | 21 |
| University | 12 | 6 | 9 |
| University hospital | 7 | 10 | 8 |
| Medical practice in private sector (e.g., company physician) | 6 | 11 | 8 |
| International hospital | 9 | 1 | 6 |
| Other medical and health environment | 4 | 3 | 3 |
| Other Non-medical and health environment | 2 | 3 | 3 |
| Research organisation | 1 | 0 | 1 |
| Total | 100 | 100 | 100 |
| Count | 85 | 71 | 156 |

*Note*. Question D8: In which environment are you working now?

Regarding the type of employers, most graduates stated that they were working for governmental institutions (50%) and private companies (40%). Few graduates were working for non profit organisations (4%) or were self employed (6%) (Table 4.14).

Table 4.14
Kind of current employer (percent)

| | Female | Male | |
|---|---|---|---|
| Governmental institution | 48 | 52 | 50 |
| Private company | 42 | 37 | 40 |
| Self employed | 5 | 7 | 6 |
| Non Profit Organisation | 5 | 3 | 4 |
| Other | 0 | 1 | 1 |
| Total | 100 | 100 | 100 |
| Count | 85 | 71 | 156 |

*Note*. Question D7: Please state the kind of your current employer/ institution. Please mark one single item only.

Table 4.15
Approximate monthly gross income (in million Rupiah)

| | Female | Male | Total |
|---|---|---|---|
| Arithmetic mean | 6.35 | 7.48 | 6.85 |
| Median | 5.00 | 6.00 | 5.20 |
| Standard deviation | 6.43 | 5.93 | 6.22 |
| Count | 81 | 66 | 147 |

*Note*. Question D11: What is your approximate monthly gross income? From current major job (including overtime and extra payments) and from other jobs in million Rupiah.

Graduates reported an average income of 6.85 million Indonesian Rupiah (IDR), with a variation in regards to gender. Male graduates reported higher income than female

graduates (7.48 million and 6.35 million respectively) (Table 4.15). This number is equal to about € 6,850 per year (1 Euro is equal to 12.000 IDR when the survey was conducted). The number is less than a quarter when compared to the average income of graduates working in Europe. The report from CHEERS showed that, four years after graduation, full-time working graduates in western Europe had an annual gross income from €16,000 (Spain) to €38,000 (Germany) (WZ1, 2000). Obviously, this comparison does not take into consideration taxes, social security, and purchasing power parity. And also most graduates (73%) in the present study were from 2004 and 2005 cohort which means less than two years after graduation. Nevertheless this gives a general insight about the big income gap between Indonesia and Europe. Additionally, it's important to consider that the CHEERS survey was conducted in 1999 and the income data were from all fields of studies not specifically in medicine.

## 4.5 Competencies

Graduates were asked to rate the extent to which they had certain competencies at the time of graduation and at the time the survey was conducted. Graduates have to respond to a list of 32 competencies indicators with a scale ranging from 1 "Not at all" to 5 "To a very high extent". Based on the result of exploratory factor analysis, described in section 4.2.2, the competencies were grouped into four factors (Leadership, Interpersonal competencies, Field-related competencies, and Personal and organisational competencies). Three indicators were removed during the factor analysis process, therefore the final list consisted of 29 competencies.

Table 4.16 depicts graduates' competencies at the time of graduation. The percentages shown represent the number of graduates who rated 4 or 5 to the indicator of competencies. The highest rating was found in *adaptability* (81%), *tolerance, appreciating different points of view* (81%), and *loyalty, integrity* (80%), in which four out of five graduates rated them highly. Compared to the rating of other indicators, graduates rated them self inadequate in *economic reasoning* (40%) and *understanding complex social, organisational and technical system* (43%).

Table 4.16
Competencies at the time of graduation (percent; responses 4 and 5*)

| | Female | Male | Total |
|---|---|---|---|
| Personal and organisational competencies | | | |
| Loyalty, integrity | 78 | 83 | 80 |
| Working in a team | 77 | 80 | 78 |
| Working independently | 76 | 78 | 77 |
| Analytical competencies | 66 | 75 | 70 |
| Reflective thinking, assessing one's own work | 68 | 71 | 69 |
| Taking responsibilities, decisions | 64 | 75 | 69 |
| Problem-solving ability | 58 | 76 | 66 |
| Initiative | 63 | 66 | 65 |
| Working under pressure | 60 | 66 | 63 |
| Leadership | | | |
| Creativity | 56 | 65 | 60 |
| Leadership | 56 | 59 | 57 |
| Applying rules and regulations | 59 | 51 | 56 |
| Documenting ideas and information | 56 | 54 | 55 |
| Negotiating | 52 | 55 | 54 |
| Planning, co-ordinating and organising | 55 | 50 | 53 |
| Understanding complex social, organisational and technical systems | 42 | 44 | 43 |
| Economic reasoning | 39 | 41 | 40 |
| Field-related competencies | | | |
| Critical thinking | 63 | 81 | 71 |
| Self-directed learning skills | 68 | 73 | 70 |
| Cross-disciplinary thinking/knowledge | 65 | 70 | 67 |
| Field-specific theoretical knowledge | 68 | 58 | 64 |
| Broad general knowledge | 61 | 68 | 64 |
| Field-specific knowledge of methods | 62 | 53 | 58 |
| Interpersonal competencies | | | |
| Tolerance, appreciating different points of view | 78 | 85 | 81 |
| Adaptability | 81 | 80 | 81 |
| Collaboration skills | 67 | 78 | 72 |
| Oral communication skills | 72 | 73 | 72 |
| Written communication skills | 66 | 69 | 67 |
| Coping with uncertainty | 60 | 64 | 62 |
| Count | 101 | 80 | 181 |

*Note*. Question E1: Please, state the extent to which you had the following competencies at the time of graduation (awarded with Bachelor of Medicine, B.Med.). *Responses 4 and 5 on a rating scale from 1 "Not at all" to 5 "To a very high extent".

There are no big differences in competencies ratings at the time of graduation between male and female graduates, however there are some exceptions. Based on the Wilcoxon-Mann-Whitney test, male graduates reported a higher rating than female graduates in: *problem solving ability* ($Z$ = -2.67, $p$ = .00), *critical thinking* ($Z$ = -2.76, $p$ = .00), *collaboration skills* ($Z$ = -1.68,

*p* =.045), *analytical competencies* (*Z* = -2.16, *p* = .015), and *tolerance, appreciating different points of view* (*Z* = -2.06, *p* = .015). Conversely, female graduates reported a higher rating in *field-specific theoretical knowledge* (*Z* = -1.69, *p* = .045).

Generally the ratings on the Leadership factor are lower than other factors. The low rating on the Leadership factor is in accordance with the result of a Gadjah Mada University (UGM) graduates survey conducted in 2003 (UGM, 2004). The 2003 survey had recommended an improvement in graduates leadership, self confidence, negotiation skills, and entrepreneurship (UGM, 2004). However in the current study the rating of the Leadership factor, especially in *negotiating* (54%) and *leadership* (57%) are still in the low category. On the other hand, the high rating of the Interpersonal competencies factor in this study (e.g. tolerance (81%), adaptability (81%), collaboration skills (72%), and oral communication skills (72%)) showed that UGM had fulfilled the recommendation of the 2003 graduate survey.

In the CHEERS study the graduates were asked to rate how the competencies were required in the workplace (WZ1, 2000). Instead of asking about the requirement in the workplace, in the present study graduates were asked to rate their competencies at the current time (when the survey was conducted). This method was believed to simplify the estimation and judgement needed by graduates to answer or rate their responses. Thus, it avoids complicated judgement and heavy demand in memory and allows graduates to provide more accurate responses (Groves, et al., 2004; Rozenblit & Keil, 2002).

Table 4.17 depicts the comparison between competencies at graduation and the current competencies (at the time of the survey). As expected, the competencies rating at current time exceed graduates' acquired competencies.

The biggest differences were found in the Leadership factor, particularly in *understanding complex social, organisational and technical systems*. In which only 34% of the graduates reported high rating at the time of graduation, compared to 77% of the graduates reporting the same rating at the current time (34% gap). Other high discrepancies were found in *planning, co-ordinating and organising* (26%), *economic reasoning* (23%), *negotiating* (23%), *documenting ideas and information* (19%), *leadership* (19%), and *analytical competencies* (19%).

Table 4.17
Comparison of competencies at graduation and current time (percent, responses 4 and 5*)

| | Competencies at graduation | Competencies now** | Difference |
|---|---|---|---|
| Personal and organisational competencies | | | |
| Analytical competencies | 70 | 89 | 19 |
| Problem-solving ability | 66 | 84 | 18 |
| Working under pressure | 63 | 81 | 18 |
| Taking responsibilities, decisions | 69 | 86 | 17 |
| Reflective thinking, assessing one's own work | 69 | 84 | 15 |
| Initiative | 65 | 79 | 14 |
| Working independently | 77 | 88 | 11 |
| Working in a team | 78 | 87 | 9 |
| Loyalty, integrity | 80 | 88 | 8 |
| Leadership | | | |
| Understanding complex social, organisational and technical systems | 43 | 77 | 34 |
| Planning, co-ordinating and organising | 53 | 79 | 26 |
| Economic reasoning | 40 | 63 | 23 |
| Negotiating | 54 | 77 | 23 |
| Documenting ideas and information | 55 | 74 | 19 |
| Leadership | 57 | 76 | 19 |
| Applying rules and regulations | 56 | 74 | 18 |
| Creativity | 60 | 76 | 16 |
| Field-related competencies | | | |
| Broad general knowledge | 64 | 81 | 17 |
| Field-specific knowledge of methods | 58 | 69 | 11 |
| Cross-disciplinary thinking/knowledge | 67 | 77 | 10 |
| Self-directed learning skills | 70 | 80 | 10 |
| Critical thinking | 71 | 80 | 9 |
| Field-specific theoretical knowledge | 64 | 68 | 4 |
| Interpersonal competencies | | | |
| Coping with uncertainty | 62 | 77 | 15 |
| Written communication skills | 67 | 81 | 14 |
| Collaboration skills | 72 | 85 | 13 |
| Oral communication skills | 72 | 82 | 10 |
| Tolerance, appreciating different points of view | 81 | 88 | 7 |
| Adaptability | 81 | 86 | 5 |
| Count | 65 | 79 | 14 |

*Note*. Question E1: Please, state the extent to which you had the following competencies at the time of graduation (awarded with Bachelor of Medicine, B.Med.). E2: Please, state the extent to which you had the following competencies now. *Responses 4 and 5 on a rating scale from 1 "Not at all" to 5 "To a very high extent". **At the time of the survey was conducted.

The discrepancy between competencies at graduation and at the time of taking the survey is not necessarily a bad thing. It means that graduates acquired additional competencies since graduation. The competencies could be acquired from work experiences, further training and

education, or other life experiences. On the other hand it could mean also that graduates did not have enough competencies when they graduated. Therefore graduates have to upgrade their competencies in order to meet the demand in the workplace.

Considering this as a reference one notion that should be considered by UGM is the Leadership competencies because the biggest gap was found in the Leadership factor. Moreover, considering that UGM's graduate survey in 2003 already identified the deficiency in leadership competencies, this means after one decade the issue is still present. This does not mean that there is no improvement in leadership competencies development in UGM. Rather, it provides an evidence that higher education institutions should always improve competencies development (e.g., leadership, negotiation) in order to prepare graduates for the world of work.

Another thing that should be considered is that the current survey data is only from graduates who experienced PBL which is deemed to have advantages in developing leadership competencies (Patria, 2011; Prince, et al., 2005). The gap in all field of studies is predicted to be much higher.

## 4.6 Relationship between higher education and work

A number of sections of this chapter indirectly mentioned the relationship between higher education and the world of work. The present section addresses whether graduates consider their education as matching with their work or not. In Section F of the questionnaire, graduates were asked about the relationship between knowledge and skill acquired in the course of study and their utilisation in their work tasks. Graduates were also asked whether their academic degree is suitable for their job. Additionally, graduates were asked whether their current job meets the expectation they had when they started their study.

Table 4.18 illustrates the relationship between higher education and work. About three quarters of the graduates (74%) reported a high or very high extent of use of knowledge and skills (acquired during the course of study) on their job. Only a very small percentage (1%) stated no use of medicine knowledge and skills in the job. This result is expected in a professional occupation such as medicine. As shown in Table 4.18, there is little variation of the values in regards of gender.

Table 4.18
Relationship between higher education and work (percent; arithmetic mean)

| | Female | Male | Total |
|---|---|---|---|
| 1 Not at all | 1 | 0 | 1 |
| 2 | 4 | 2 | 3 |
| 3 | 19 | 25 | 22 |
| 4 | 55 | 49 | 52 |
| 5 To a very high extent | 21 | 25 | 22 |
| Total | 100 | 100 | 100 |
| Count | 73 | 65 | 138 |
| Recoded values | | | |
| 1 and 2 | 5 | 2 | 4 |
| 3 | 19 | 25 | 22 |
| 4 and 5 | 75 | 74 | 75 |
| Arithmetic mean | 3.9 | 4.0 | 3.9 |

*Note*. Question F1: If you take into consideration your current work tasks altogether: To what extent do you use the knowledge and skills acquired in the course of study. Rating scale from 1 "Not at all" to 5 "To a very high extent".

The high use of knowledge and skill is also confirmed with the appropriateness of academic degree for their job. About two third of the graduates consider their job and employment suitable for their level of education (Table 4.19). However, 29% of graduates perceived that their work demands a higher level of education than a professional degree in medicine. This most likely indicates the lack of medical specialists in the workplace; therefore graduates have to take over the assignments of medical specialists.

Only a few graduates (5%) consider that their job requires the same level as a bachelor in medicine.

Table 4.19
Appropriate academic degree suited for current job (percent)

| | Female | Male | Total |
|---|---|---|---|
| Higher level than professional degree in medicine | 26 | 34 | 29 |
| The same level with professional degree in medicine | 69 | 60 | 65 |
| The same level with bachelor in medicine | 4 | 6 | 5 |
| Other | 1 | 0 | 1 |
| Total | 100 | 100 | 100 |
| Count | 74 | 65 | 139 |

*Note*. Question F2: Which academic degree is in your opinion best suited for your current job?

The fact that almost one third of graduates has to tackle assignments for medical specialist might explain why graduates reported deficiencies in all competencies indicators (see Table 4.17).

Overall, when asked whether their current job meets the expectation they had when they started their study, 61% of graduates reported that the condition is better than what they expected (Table 4.20). Table 4.20 depicts that the current work situation somewhat differs by gender. Only 12% of female graduates reported a much better work condition than expected during study while the percentage is almost double in male graduates (21%). This could imply that female graduates landed in a worse working condition than their male colleagues. Or it could be also the case that female graduates have had higher expectations during study.

Table 4.20
Current work situation in relation with the expectations during study (percent; arithmetic mean)

| | Female | Male | Total |
|---|---|---|---|
| 1 Much worse than expected | 3 | 0 | 1 |
| 2 | 8 | 6 | 7 |
| 3 | 32 | 27 | 30 |
| 4 | 45 | 46 | 45 |
| 5 Much better than expected | 12 | 21 | 16 |
| Total | 100 | 100 | 100 |
| Count | 74 | 63 | 137 |
| Recoded values | | | |
| 1 and 2 | 11 | 6 | 9 |
| 3 | 32 | 27 | 30 |
| 4 and 5 | 57 | 67 | 61 |
| Arithmetic mean | 3.6 | 3.8 | 3.7 |

*Note*. Question F3: Taking all aspects into account, to what extent does your current work situation meet the expectations you had when you started your study? Rating scale from 1 "Much worse than expected" to 5 "Much better than expected".

## 4.7 Professional orientation and satisfaction

Graduates were asked to rate the importance of occupational characteristics on a list of 19 indicators. The rating was ranged from 1 'Not at all important' to 5 'Very important'. Table 4.21 depicts the complete list of occupational characteristics grouped into five factors: Autonomy, Income and status, Social opportunities, Task significance, and Learning opportunities. The grouping was based on the result of factor analysis on job characteristics

by Patria (2008). The factor analysis was conducted using the job characteristics model by Hacman and Lawler (Gibson, Invancevich, & Donnelly, 2000). One indicator, *clear and well-ordered tasks*, was excluded because it was not available in the grouping by Patria (2008).

Graduates generally showed a balanced work orientation, they have high aspiration in all factors of job characteristics (Table 4.21). In Autonomy factor highest percentages were found in *opportunity of pursuing continuous learning* (93%), *largely independent disposition of work* (88%), and *opportunity of pursuing own ideas* (86%). In Income and status factor, *job security* (94%) is the highest rating followed by *good career prospects* (93%) and *high income* (81%).

Table 4.21
Work orientation (percent, responses 4 and 5*)

| | Female | Male | Total |
|---|---|---|---|
| Autonomy | | | |
| Opportunity of pursuing continuous learning | 92 | 94 | 93 |
| Largely independent disposition of work | 89 | 87 | 88 |
| Opportunity of pursuing own ideas | 90 | 82 | 86 |
| Challenging tasks | 71 | 79 | 75 |
| Variety | 76 | 74 | 75 |
| Income and status | | | |
| Job security | 96 | 91 | 94 |
| Good career prospects | 93 | 94 | 93 |
| High income | 77 | 86 | 81 |
| Social recognition and status | 74 | 67 | 71 |
| Social opportunities | | | |
| Good social climate | 90 | 92 | 91 |
| Good chances of combining employment with family tasks | 85 | 86 | 85 |
| Enough time for leisure activities | 81 | 83 | 82 |
| Task significance | | | |
| Chance of doing something useful for society | 90 | 91 | 90 |
| Possibility of working in a team | 82 | 78 | 80 |
| Co-ordinating and management tasks | 69 | 68 | 69 |
| Chances of (political) influence | 33 | 39 | 36 |
| Learning opportunities | | | |
| Possibilities of using acquired knowledge and skills | 93 | 94 | 93 |
| Opportunity of undertaking scientific/scholarly work | 80 | 69 | 75 |
| Count | 96 | 78 | 174 |

*Note*. Question G1: How important are the following characteristics of an occupation for you personally? *Responses 4 and 5 on a rating scale from 1 'Not at all important' to 5 'Very important'.

In the Social opportunities factor, *good social climate* (91%) and *good chances of combining employment with family task* (85%) seems to be the most important for graduates. In the Task

significance factor, the highest percentage is found in *chance of doing something useful for society* (90%). *Possibility of using acquired knowledge and skills* (93%) is rated as the highest in learning opportunity factor.

Female and male graduates generally have the same preference on work orientation. However, male graduates seem more interested in a *challenging task* than their female colleagues (79% vs. 71%). The same condition was found in the preference of *high income* (86% male vs. 77% female). Female graduates reported higher interest in the *opportunity of pursuing own ideas* (90% vs. 82%), *opportunity of undertaking scientific work* (80% vs. 69%), and *job security* (96% vs. 91%).

To give a broader insight on graduates' profile in each factor of work orientation, item parcelling method was used to create new factor-variables. The method was previously described in Section 4.2.2. Table 4.22 illustrates graduates mean score in each factor variable of work orientation. As mentioned before, graduates have relatively high rating on each factor. This affirmed the statement mentioned before that graduates have a balanced state on each factor of job characteristics. One might be concerned about the rating of the Task significance factor that is lower than other factors (*Mean* = 3.82, *SD* = .65, *Mdn* = 3.75). The low value of Task significance seems to be dragged by the low rating on *chance of political influence* item. When the item is excluded the average of task significance factor is increased to 4.0 (*SD* = .6, *Mdn* = 4.0).

Table 4.22
Work orientation

| | Mean | Median | SD |
|---|---|---|---|
| Autonomy | 4.16 | 4.00 | .50 |
| Income and status | 4.22 | 4.25 | .52 |
| Social opportunities | 4.24 | 4.33 | .63 |
| Task significance | 3.82 | 3.75 | .65 |
| Learning opportunities | 4.13 | 4.00 | .62 |

Graduates were not only asked to rate the work orientation but also their actual work situation. Naturally the work situations were not fully matching their ideal conditions. Table 4.23 depicts the comparison between graduates' work orientation and the actual work situation. The biggest gap was found in *high income* which indicates that graduates were disappointed with their earnings. Only 44% of all graduates reported that they have a high

income job, in comparison to 81% of graduates who stated that high income is very important for them. The same disappointment was found in *job security* (94% in work orientation vs. 58% in actual work situation). One exception was found in *chances of political influence* where graduates' rating on work situation (47%) is higher than what they have desired (36%). Another exception was found in the possibility of working in a team where graduates rating on job situation is slightly higher than what they have expected (81% vs. 80%).

Table 4.23
Comparison between work orientation and work situation (percent, responses 4 and 5*)

| | Work orientation | Work situation | Differences |
|---|---|---|---|
| Autonomy | | | |
| Opportunity of pursuing own ideas | 86 | 59 | 27 |
| Opportunity of pursuing continuous learning | 93 | 68 | 25 |
| Variety | 75 | 61 | 14 |
| Challenging tasks | 75 | 64 | 11 |
| Largely independent disposition of work | 88 | 81 | 7 |
| Income and status | | | |
| High income | 81 | 44 | 37 |
| Job security | 94 | 58 | 36 |
| Good career prospects | 93 | 68 | 25 |
| Social recognition and status | 71 | 66 | 5 |
| Social opportunities | | | |
| Good chances of combining employment with family tasks | 85 | 59 | 26 |
| Enough time for leisure activities | 82 | 63 | 19 |
| Good social climate | 91 | 72 | 19 |
| Task significance | | | |
| Chance of doing something useful for society | 90 | 76 | 14 |
| Co-ordinating and management tasks | 69 | 58 | 11 |
| Possibility of working in a team | 80 | 81 | -1 |
| Chances of (political) influence | 36 | 47 | -11 |
| Learning opportunities | | | |
| Opportunity of undertaking scientific/scholarly work | 75 | 54 | 21 |
| Possibilities of using acquired knowledge and skills | 93 | 74 | 19 |

*Note*. Question G1: How important are the following characteristics of an occupation for you personally? Rating of answer from 1 'Not at all important' to 5 'Very important'. G2: To what extent the following characteristics of an occupation apply to your current professional situation. *Responses 4 and 5 on a rating scale from 1 'Not at all' to 5 'To a very high extent'.

Figure 4.1 shows the mean comparison of work orientation and situation in each factor of job characteristics. The factor variables in work situation, as work orientation, were also created by the item parcelling method. As shown in Figure 4.1 the differences of work orientation

and situation in each factor are apparently small. However, the differences are significant based on the Wilcoxon Sign Rank Test. Significant differences are found in Autonomy ($Z$ = -6.95, $p$ < .00), Income and status ($Z$ = -7.42, $p$ < .00), Social opportunities ($Z$ = -7.00, $p$ < .00), and Learning opportunities ($Z$ = -5.94, $p$ < .00). One exception is in task significance where the difference between work orientation and situation is not significant ($Z$ = -1.44, $p$ = ns.).

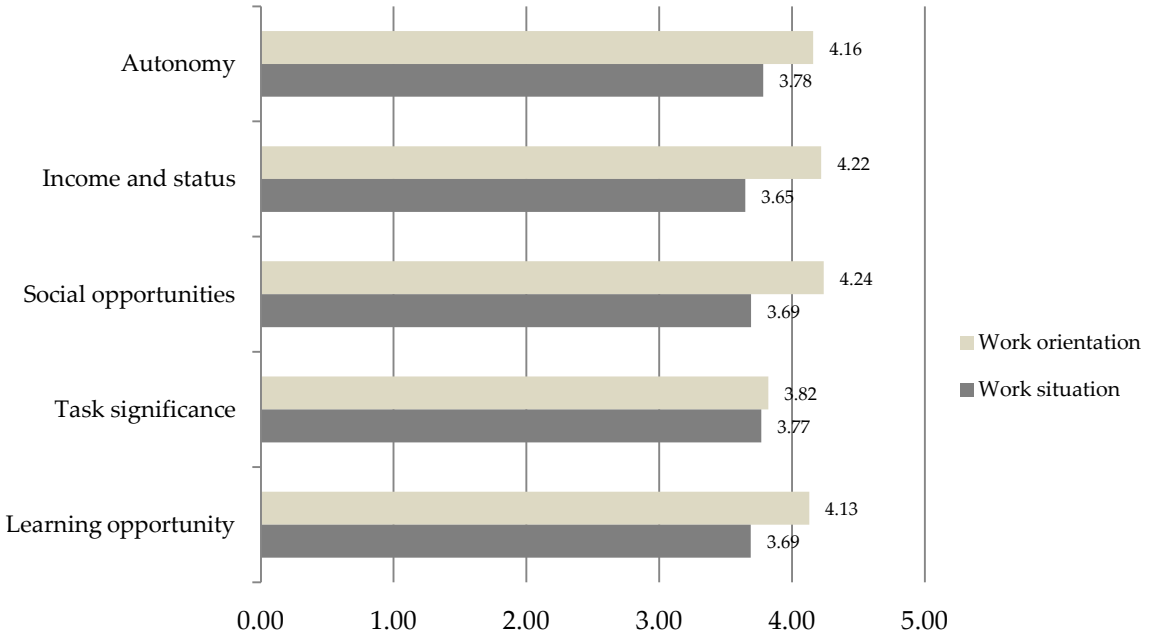



Figure 4.1 Comparison of work orientation and work situation

Even though there is a significant difference between what graduates wanted and what they actually received in their current work, graduates are generally satisfied with their current work situation. When asked about their overall satisfaction with the current work, more than half of graduates (59%) reported that they were satisfied or very satisfied and only few (7%) were very dissatisfied.

## 4.8 Summary

As suggested in the title of this chapter, the purpose of this chapter is to provide descriptive statistics of the survey conducted in the Faculty of Medicine, Gadjah Mada University.

The descriptive statistics provides more insight about the subjects of the study. The information about graduates' socio-biographic background, the learning environment, and

the transition from higher education to work are important background information for the discussion in the following chapters. Additionally, the statistics also provide information about the relationship between higher education and employment, the use of competencies acquired during study, and the general employment condition. The following paragraphs summarize the findings from descriptive statistics.

From the perspective of graduates, the study conditions in the faculty of Medicine, Gadjah Mada University (UGM) were improving in each cohort. The implementation of full PBL method in 2003 had an impact on the overall study condition. For example, practical emphasis in teaching and learning was intensified in 2003. Graduates reported that there was improvement in the provision of academic advice and more opportunities for out-of-class contacts with teaching staff. Additionally, there was also improvement in the equipment and stocking of libraries. On the other hand, the implementation of full-PBL in 2003 occupied most of the faculty time. Therefore graduates from the 2003 cohort reported limited opportunities to get individual occupational advice.

Graduates ratings on PBL implementation suggest that UGM should improve their tutors' qualification. Graduates rated the Teacher as facilitator component lower than other PBL components. Graduates reported that the tutors did not have a clear picture about their role as tutor and that the tutors should be more motivated in serving their role. In contrast, graduates have positive views on the small-group learning environment which encourage a more intense group discussion. This also promotes a more active involvement in the process of learning.

In the transition phase from higher education to work, the most interesting fact is perhaps in the high use of personal contacts in job search. This supports the common belief about nepotism in medical education and also in health sector employment.

Graduates believe that employers were highly considering the reputation of UGM as a decisive attribute in recruitment process. Other important attributes in recruitment process are field of study and personality.

Female graduates were more likely than male to be unemployed, working under temporary contract, and married. Thus, they generally had lower income than their male colleagues.

There was a low mobility of graduates after graduation. Graduates prefer to work in Yogyakarta and the surrounding city in Middle Java province. This is important to note because there are many areas in Indonesia with an insufficient number of physicians.

Compared to the result of UGM graduate survey in 2003, graduates in the present study reported improvement in interpersonal competencies such as tolerance, adaptability, collaboration skills and communication skills. However, the overall responses to competencies list showed inadequacy in leadership factor, especially in: economic reasoning; understanding complex social, organisational, and technical system; negotiation skills, and leadership.

In the relationship between higher education and work, graduates reported a high use of knowledge and skills (acquired during study) on their job. Graduates reported also that they have to take over assignments which were suitable for a medical specialist (a higher level of education than the graduates). Nevertheless, more than half of graduates reported that they have a much better work condition than what they expected during study.

Graduates have a balanced aspiration in all job characteristics components, i.e. autonomy, income and status, social opportunities, task significance, and learning opportunities. On the other hand, when asked whether their aspirations were fulfilled by the current work, graduates were mostly dissatisfied with their income and job security.

The next chapter presents the result of confirmatory factor analysis (CFA) to provide evidence of validity and reliability of the instrument.

# 5 Validity and reliability

This chapter corroborates the development of problem-based learning (PBL) implementation and the graduates' competencies questionnaire. The result of confirmatory factor analysis (CFA) is reported in this chapter in order to assure the validity and reliability of the questionnaires.

This chapter starts with the development of the individual constructs and a measurement model of the PBL questionnaire. Afterwards, each individual construct of graduates' competencies are discussed.

## 5.1 Problem-based learning implementation questionnaire

To assure the validity and reliability of the PBL questionnaire several procedures were conducted. As mentioned in Chapter 3, measurement model validity does not depend on the goodness-of-fit (GOF) only, but it also depends on the evidences of construct validity (Hair, et al., 2010). The construct validity in this study was achieved by conducting necessary procedures to establish face validity, convergent validity, and discriminant validity.

Face validity of the questionnaire was checked by experts in PBL research and methodology (see Section 3.2.2). Classical reliability analysis was conducted to check the internal consistency of the questionnaire. Table 5.1 displays the result of Cronbach's alpha for each factor including the mean and standard deviation of each item.

All Alpha coefficients were above minimum level of .70 (Nunnally, 1981). The values were ranging from .787 (Small group) to .921 (Teacher as facilitator and Self-directed learning). The Alpha coefficient for total items was .963. This means that the questionnaire is internally consistent in measuring the construct.

Table 5.1
Indicators of PBL questionnaire

| | Mean | SD | Alpha |
|---|---|---|---|
| Student-centred learning | | | .798 |
| Students are responsible for their own learning | 3.92 | .783 | |
| Students are actively involved in the process of learning | 3.80 | .777 | |
| Students have autonomy in the process of learning | 3.70 | .832 | |
| Teacher is not the main source of information | 3.82 | .888 | |
| Equal role of teacher and students (interdependence) | 3.22 | .912 | |
| Emphasis on deep learning | 3.31 | .982 | |
| Small group | | | .787 |
| Learning process occurs in a small group (5-9 students). | 3.93 | .861 | |
| The group size is appropriate to stimulate group discussion | 3.87 | .845 | |
| The learning groups have positive atmosphere (non-threatening) | 3.71 | .764 | |
| The group size is appropriate to encourage active student participation | 3.77 | .778 | |
| Problem as stimulus | | | .905 |
| The problems in the tutorial process | | | |
| …match with students' level of knowledge | 3.78 | .741 | |
| …stimulate thinking, analysis, and reasoning | 3.82 | .789 | |
| …assure self-directed learning | 3.58 | .888 | |
| …activate students' prior knowledge | 3.69 | .842 | |
| …lead to the discovery of the learning objectives | 3.56 | .867 | |
| …arouse students' curiosity | 3.78 | .768 | |
| …use appropriate vocabulary | 3.58 | .831 | |
| Real-world problems | | | .886 |
| The problems in the tutorial process | 3.70 | .699 | |
| …are realistic | 3.80 | .773 | |
| …are clinically relevant | 3.68 | .777 | |
| …related to a public health topic | 3.70 | .788 | |
| …generate multiple hypotheses about their cause and solution | 3.70 | .699 | |
| Teacher as facilitator | | | .921 |
| The tutors have a clear picture about their strengths/ weaknesses as a tutor | 3.14 | .882 | |
| The tutors are clearly motivated to fulfill their role as a tutor | 3.23 | .796 | |
| The tutors stimulate the students | | | |
| …to summarize what they had learnt in their own words | 3.19 | .875 | |
| …to search for links between issues discussed in the tutorial group | 3.44 | .770 | |
| …to understand underlying mechanisms/theories | 3.59 | .799 | |
| …to apply knowledge to the discussed problem | 3.62 | .757 | |
| …to apply knowledge to other situations/problems | 3.47 | .738 | |
| …to give constructive feedback about the group work | 3.42 | .832 | |
| …to evaluate group co-operation regularly | 3.16 | .909 | |

(Table 5.1 continues)

(Table 5.1 continued)

| | Mean | SD | Alpha |
|---|---|---|---|
| Self-directed learning | | | .921 |
| Students take initiative in diagnosing their learning needs | 3.48 | .899 | |
| Students formulating the learning goals | 3.39 | .931 | |
| Students decide the resources (human and material) for learning | 3.76 | .901 | |
| Students choose appropriate learning strategies | 3.51 | .926 | |
| Students evaluate the accuracy and value of the resources | 3.41 | .877 | |
| Students self-monitor their learning progress | 3.37 | .922 | |
| Students self-assess their learning outcome | 3.26 | .943 | |
| Total | | | .963 |

The Omega hierarchical coefficient ($\omega h$) for the PBL implementation scale was .97. This means that the indicators of PBL implementation scale measure a latent variable in common (Zinbarg, Yovel, Revelle, & McDonald, 2006) which is the implementation of PBL in the institution. The Omega hierarchical coefficient was calculated with *psych* package in R statistical software.

The data used in this study were from a graduate survey of medicine faculty, Gadjah Mada University, Indonesia. The data consisted of graduates awarded M.D title from 2009 - 2011. The data initially consisted of 225 graduates. The non-responses were excluded from the data set. This means that graduates who had 37 missing values in PBL questionnaire (fail to fill all indicators) were excluded from the analysis. After removing the non-responses, the data consisted of 207 graduates and still contained a few missing values (.09%). Imputation method (mean substitution) was applied to the rest of the missing values. This was done with series mean method in SPSS.

There are other methods in handling missing data, e.g. listwise deletion, pairwise deletion and model-based approach. However, as suggested by Hair (2010), if missing data are random, less than 10 percent and the factor loading are relatively high (.7 or greater), then any of the approaches are appropriate. In the case of PBL questionnaire, the missing data were random, below 10 percent (.09%) and further analysis showed that most loadings were higher than .7.

The imputation method (mean substitution) was chosen in this study because the procedure allows the production of modification indices in structural model analysis. Modification indices are needed in the model respecification (see Section 3.4.1.3).

The following sections review each individual construct of the PBL implementation questionnaire. As reported before, the PBL questionnaire consisted of five factors: Student-centred learning, Small group, Problem as stimulus, Real-world problems, Teacher as facilitator, and Self-directed learning.

### 5.1.1 Student-centred learning

The Student-centred learning (SCL) individual construct model used the items described in Section 3.2.2.1. When Model 1 (Figure 5.1) was fitted to the data, the following fit indices resulted: $\chi^2$ (9, $N$ = 207) = 96.734, $p$ = .00, RMSEA = .218, CFI = .789. This result was below the requirement of a good model fit by Hair and colleagues' (2010). For a model with less than 12 observed variables and $N$ less than 250 Hair et al. suggested: CFI ≥ .97 and RMSEA < .08 (see Table 3.14 for the complete goodness-of-fit threshold).

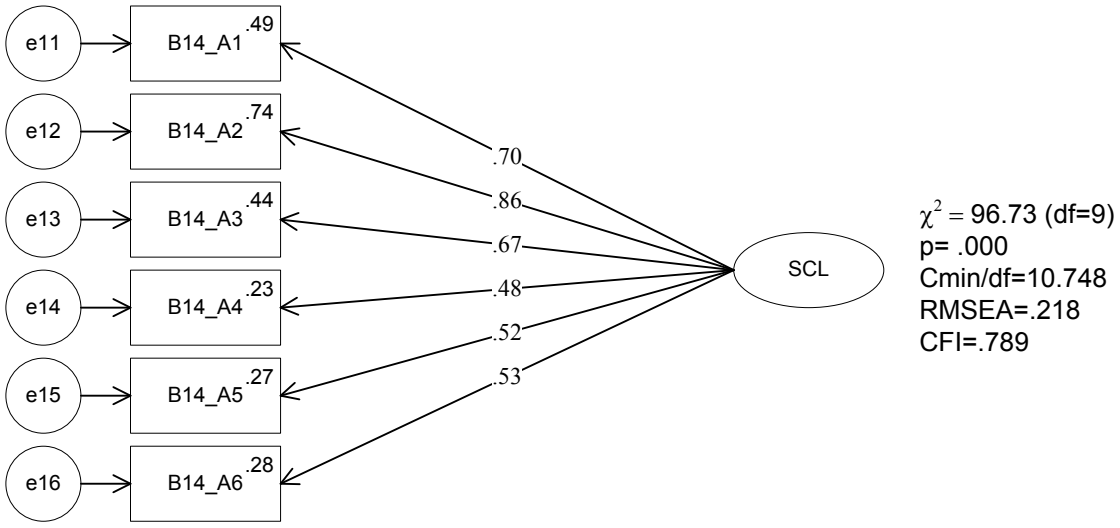



Figure 5.1 First model of Student-centred learning

Item B14_A4, "Teacher is not the main source of information", had the smallest standardized loading estimates (.48). Hair (2010) argued that standardized loading estimates ideally should be .70 or higher, or minimum .50. Consequently, item B14_A4 was not included in Model 2. The model was improved significantly in the $\chi^2$ (from 96.734 to 76.125), RMSEA (from .218 to .263), and CFI (from .789 to .800) (see Table 5.2). However, it was still below the threshold of a good model fit.

In Model 3, item B14_A5 "Equal role of teacher and students (interdependence)" was removed because the standardized loading estimates was decreased to .50 after item B14_A4 was removed in model two. Fit statistics for Model 3 improved with $\chi^2$ (2, $N$ = 207) = 2.502, $p$ = .286, RMSEA = .035 and CFI = .998.

This result met the requirement of a good model fit by Hair and colleagues' (2010). However, standardize loading estimates of item B14_A6 "Emphasis on deep learning" was decreased to .46 which is below the suggested threshold (.5). This item should be removed from the model because it would reduce the fit statistics of the measurement model. After removing item B14_A6 the model showed a perfect fit statistics (*just-identified* model) (Figure 5.2).

Table 5.2 shows the changes conducted in the development of Student-centred learning individual construct. The final indicators measuring Student-centred learning can be seen in Table 5.3.

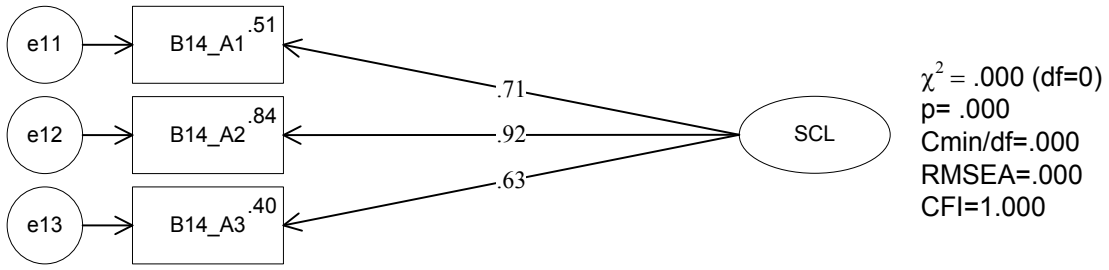



Figure 5.2 Final model of Student-centred learning

Table 5.2
Analysis steps of Student-centred learning

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 96.734 | 9 | 10.748 | .000 | .218 | .789 | |
| 2 | 76.125 | 5 | 15.225 | .000 | .263 | .800 | B14_A4 removed |
| 3 | 2.502 | 2 | 1.251 | .286 | .035 | .998 | B14_A5 removed |
| 4 | .000 | 0 | 0 | .000 | 0 | 1 | B14_A6 removed |

Table 5.3
Final indicators of Student-centred learning

| Variable | Indicators |
|---|---|
| B14_A1 | Students are responsible for their own learning |
| B14_A2 | Students are actively involved in the process of learning |
| B14_A3 | Students have autonomy in the process of learning |

### 5.1.2 Small group

The Small group individual construct model used the items described in Section 3.2.2.2. When Model 1 (Figure 5.3) was fitted to the data, the following fit indices resulted: $\chi^2$ (2, $N$ = 207) = 12.733, $p$ = .002, RMSEA = .161, CFI = .963.

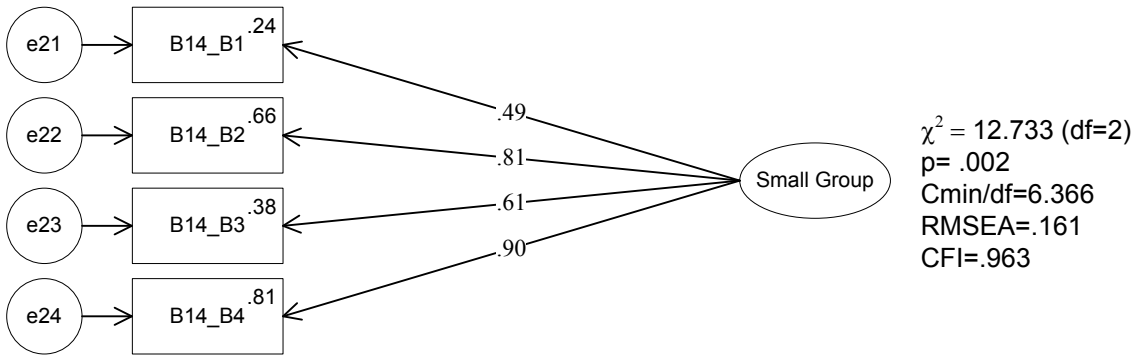



Figure 5.3 First model of Small group

Item B14_B1 "Learning process occurs in a small group (5-9 students)" was excluded from the second model because the standardized loading estimate (.49) was smaller than the suggested value (.5). The exclusion of B14_B1 turned Model 2 to *just-identified* model with perfect fit indices: $\chi^2$ (0, N = 207) = 0, p = .000, RMSEA = .000, and CFI = 1. Therefore Model 2 (Figure 5.4) was accepted as the final model of the Small group factor. Table 5.4 shows the changes of fit statistics in the development of Small group individual construct. The final indicators measuring Small group can be seen in Table 5.5.

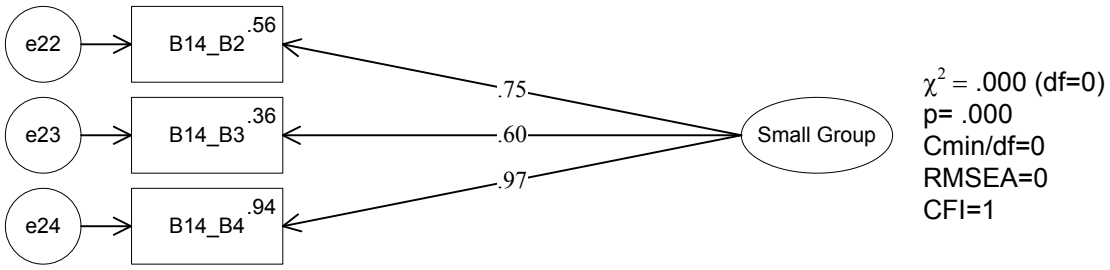



Figure 5.4 Final model of Small group

Table 5.4
Analysis steps of Small group

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 12.733 | 2 | 6.366 | .002 | .161 | .963 | |
| 2 | .000 | 0 | 0 | .000 | .000 | 1 | B14_B1 removed |

Table 5.5
Final indicators of Small group

| Variable | Indicators |
|---|---|
| B14_B2 | The group size is appropriate to stimulate group discussion |
| B14_B3 | The learning groups have positive atmosphere (non-threatening) |
| B14_B4 | The group size is appropriate to encourage active student participation |

### 5.1.3 Problem as stimulus

The individual construct model of Problem as stimulus used the indicators described in Section 3.2.2.3. When Model 1 (Figure 5.5) was fitted to the data, the following fit indices resulted: $\chi^2$ (14, $N$ = 207) = 29.877, $p$ = .008, RMSEA = .074, CFI = .981.

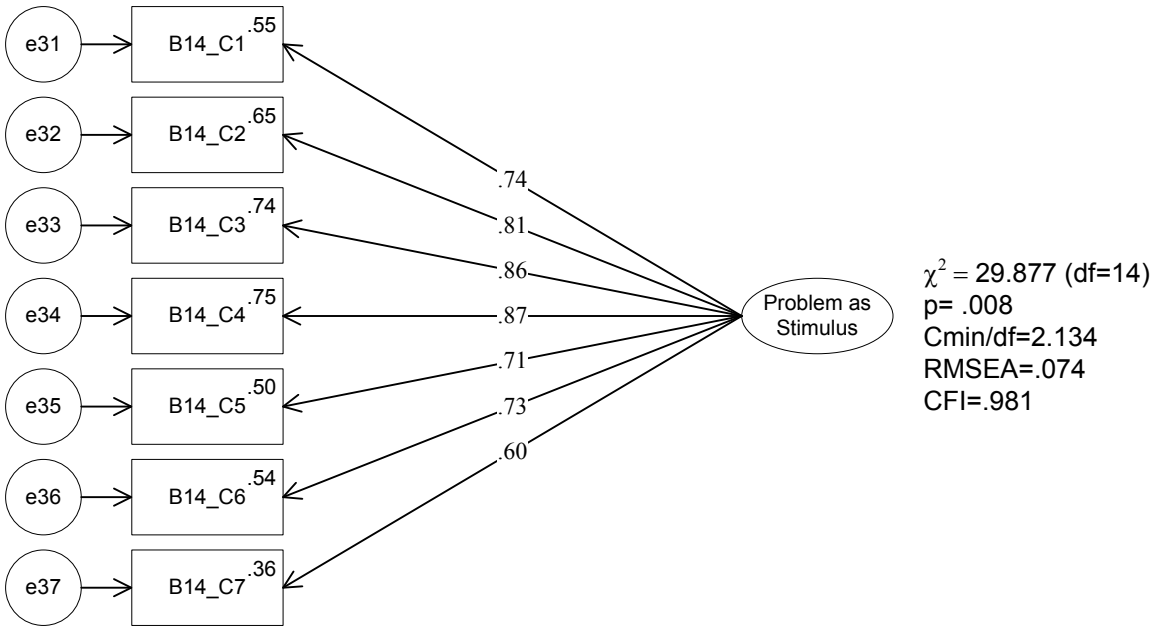



Figure 5.5 First model of Problem as stimulus

This result fulfilled the requirement of a good model fit by Hair and colleagues' (2010) criteria: CFI above .97 and RMSEA below .08. However, the factor loading of B14_C7 "The problems in the tutorial process use appropriate vocabulary" (.60) was below the ideal value (.70) which could reduce the overall fit statistics of the measurement model of PBL implementation. Therefore item B14_C7 was removed from Model 2.

Although the RMSEA in Model 2 was slightly worsened (from .074 to .075), the others fit indices showed a better values, $\chi^2$ (9, $N$ = 207) = 19.381, $p$ = .022, and CFI = .986. This result met the requirement of a good model fit by Hair and colleagues' (2010) therefore model 2

(Figure 5.6) was accepted as the final model of the Problem as stimulus. Table 5.6 shows the changes of fit statistics in the development of Problem as stimulus individual construct. The final indicators measuring Problem as stimulus can be seen in Table 5.7.

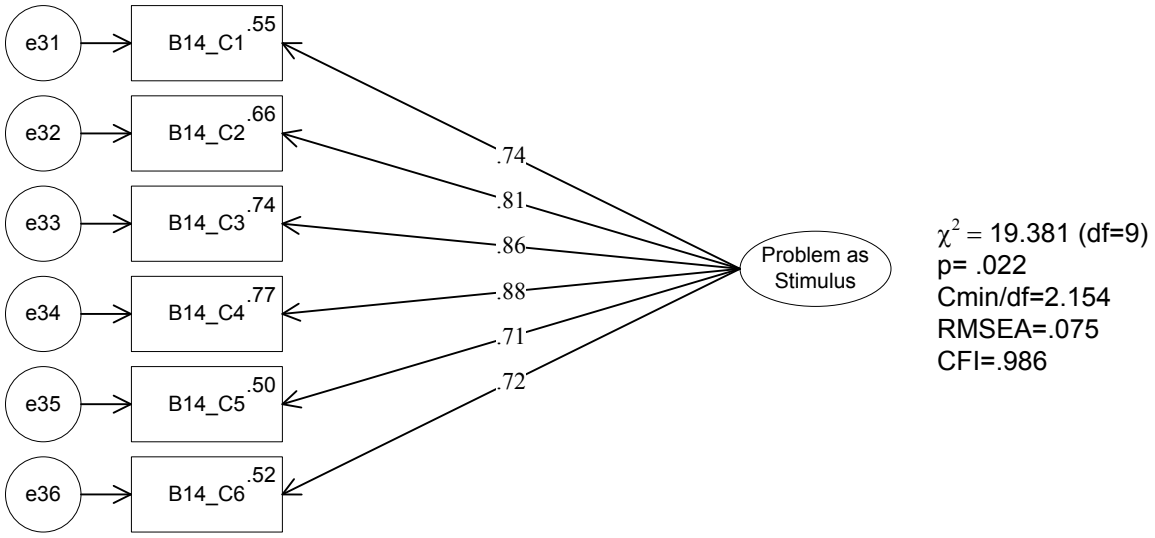



Figure 5.6 Final model of Problem as stimulus

Table 5.6
Analysis steps of Problem as stimulus

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 29.877 | 14 | 2.134 | .008 | .074 | .981 | - |
| 2 | 19.381 | 9 | 2.153 | .022 | .075 | .986 | B14_C7 removed |

Table 5.7
Final indicators of Problem as stimulus

| Variable | Indicators |
|---|---|
| | The problems in the tutorial process |
| B14_C1 | …match with students' level of knowledge |
| B14_C2 | …stimulate thinking, analysis, and reasoning |
| B14_C3 | …assure self-directed learning |
| B14_C4 | …activate students' prior knowledge |
| B14_C5 | …lead to the discovery of the learning objectives |
| B14_C6 | …arouse students' curiosity |

### 5.1.4 Real-world problems

The Real-world problems individual construct model used the items described in Section 3.2.2.4. When Model 1 (Figure 5.7) was fitted to the data, the following fit indices resulted: $\chi^2$ (2, *N* = 207) = 1.827, *p* = .401, RMSEA = .000, CFI = 1.000. This result met the requirement of a

good model fit (Hair, et al., 2010). Therefore the model was accepted as the final model of Real-world problems factor without modification.

Table 5.8 shows the complete fit statistics in the development of Real-world problems individual construct. The final indicators measuring Real-world problems can be seen in Table 5.9.

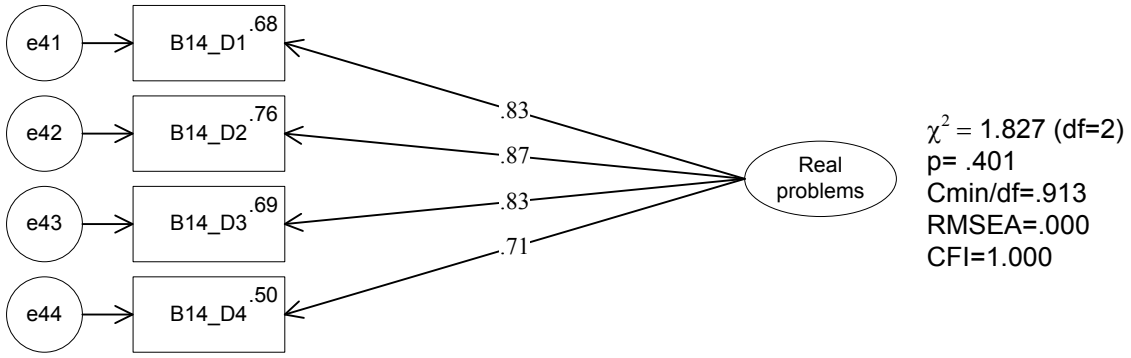



Figure 5.7 Final model of Real-world problem

Table 5.8
Fit indices of Real-world problems

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 1.827 | 2 | .913 | .401 | .00 | 1 | - |

Table 5.9
Final indicators of Real-world problems

| Variable | Indicators |
|---|---|
| | The problems in the tutorial process |
| B14_D1 | …are realistic |
| B14_D2 | …are clinically relevant |
| B14_D3 | …related to a public health topic |
| B14_D4 | …generate multiple hypotheses about their cause and solution |

### 5.1.5 Teacher as facilitator

The measurement model of Teacher as facilitator used the items described in Section 3.2.2.5. When Model 1 (Figure 5.8) was fitted to the data, the following fit indices resulted: $\chi^2$ (27, *N* = 207) = 119.582, *p* = .00, RMSEA = .172, CFI = .860. This result was below the requirement of a good model fit by Hair and colleagues' (2010) criteria: CFI ≥ .97 and RMSEA < .08.

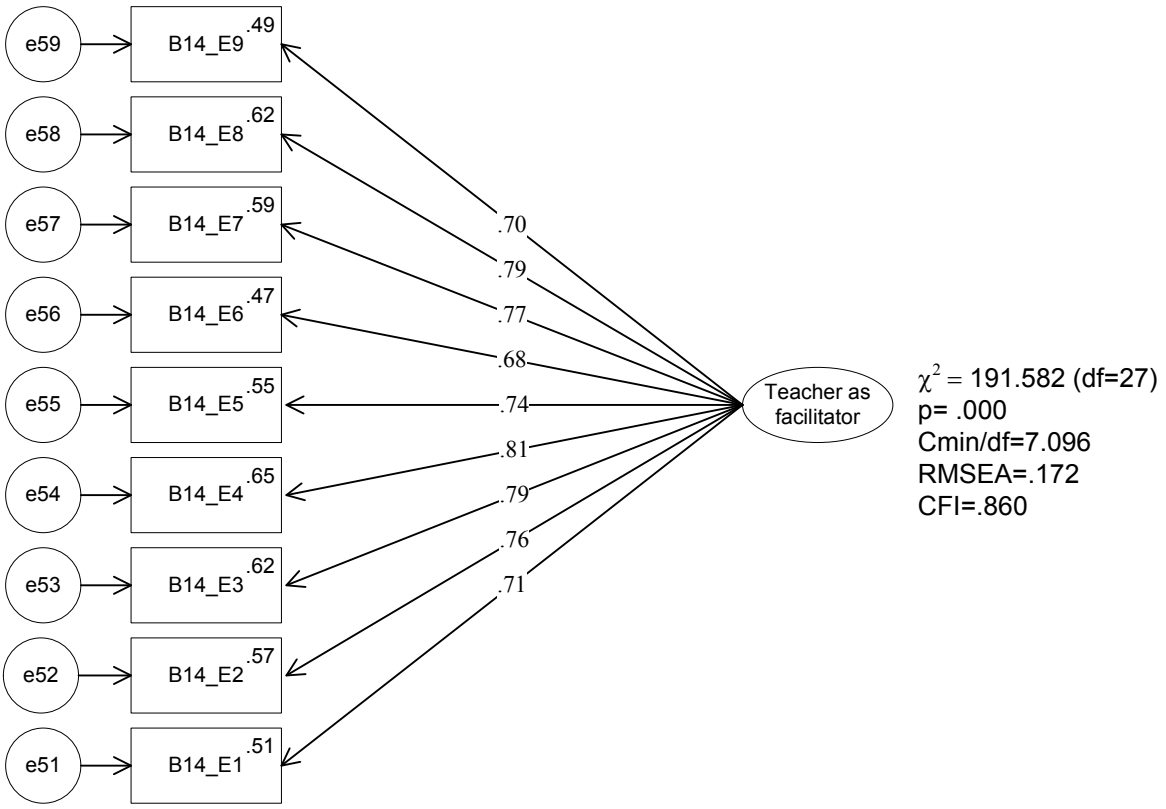



Figure 5.8 First model of Teacher as facilitator

Item B14_E6 "The tutors stimulate the students to apply knowledge to the discussed problem" had the smallest standardized loading estimates (.68). Consequently item B14_E6 was not included in Model 2. The model was improved significantly in RMSEA (from .172 to .143), and CFI (from .860 to .914) (Table 5.11). However the fit indices of Model 2 were still bellow the requirement of a good fit model by Hair et.al. (2010).

To improve the fit statistics, Model 2 was respecified based on the result of modification indices. As stated before, freeing a fixed or constrained parameter with the largest modification indices will improve the model fit, as long as the parameter can be interpreted substantively (Brown, 2006; Hair, et al., 2010). The result of modification indices for Model 2 suggested that the model could be improved by setting covariance paths between e54-e57, e51-e52, e55-e57, and e58-e59. Table 5.10 depicts the highest value of the modification indices.

Table 5.10
Modification indices for Teacher as facilitator

| Covariances | M.I. |
|---|---|
| Model 2 | |
| e54- e57 | 25.690 |
| e51- e52 | 25.202 |
| e55- e57 | 11.136 |
| e58- e59 | 10.865 |

Fit statistics for Model 3 improved with $\chi^2$ (16, $N$ = 207) = 32.013, $p$ = .010, RMSEA = .070 and CFI = .984. This result met the requirement of a good model fit by Hair and colleagues (2010), therefore Model 3 (Figure 5.9) was accepted as the final model of Teacher as facilitator.

Table 5.11 shows the changes of fit statistics in the development of Teacher as facilitator individual construct. The final indicators of Teacher as facilitator can be seen in Table 5.12.

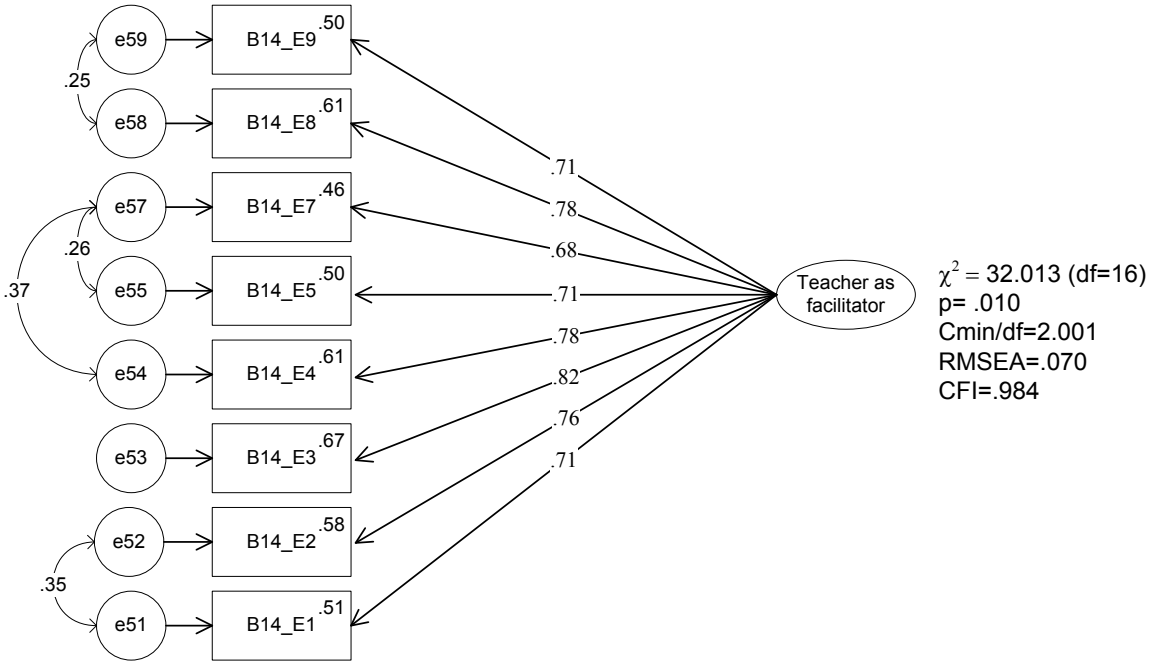



Figure 5.9 Final model of Teacher as facilitator

Table 5.11
Analysis steps of Teacher as facilitator

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 119.582 | 27 | 7.096 | .000 | .172 | .860 | - |
| 2 | 104.681 | 20 | 5.234 | .000 | .143 | .914 | B14_E6 removed |
| 3 | 32.013 | 16 | 2.001 | .010 | .070 | .984 | Covariance path: e51-e52, e54-e57, e55-e57, e58-e59 |

Table 5.12
Final indicators of Teacher as facilitator

| Variable | Indicators |
|---|---|
| B14_E1 | The tutors have a clear picture about their strengths/weaknesses as a tutor |
| B14_E2 | The tutors are clearly motivated to fulfill their role as a tutor |
| | The tutors stimulate the students |
| B14_E3 | …to summarize what they had learnt in their own words |
| B14_E4 | …to search for links between issues discussed in the tutorial group |
| B14_E5 | …to understand underlying mechanisms/theories |
| B14_E7 | …to apply knowledge to other situations/problems |
| B14_E8 | …to give constructive feedback about the group work |
| B14_E9 | …to evaluate group co-operation regularly |

### 5.1.6 Self-directed learning

The Self-directed learning model used the items described in Section 3.2.2.6. When Model 1 (Figure 5.10) was fitted to the data, the following fit indices resulted: $\chi^2$ (14, $N$ = 207) = 178.232, $p$ = .00, RMSEA = .239, CFI = .846. This result was below the requirement of a good model fit by Hair and colleagues' (2010) criteria: CFI ≥ .97 and RMSEA < .08.

The standardized loading estimates were already above the recommended value therefore all indicators were used in the model. To improve the fit indices the respecification was conducted based on the result of modification indices. The result of modification indices suggested setting covariance paths between e61-e62 and between e66-e67 (Table 5.13).

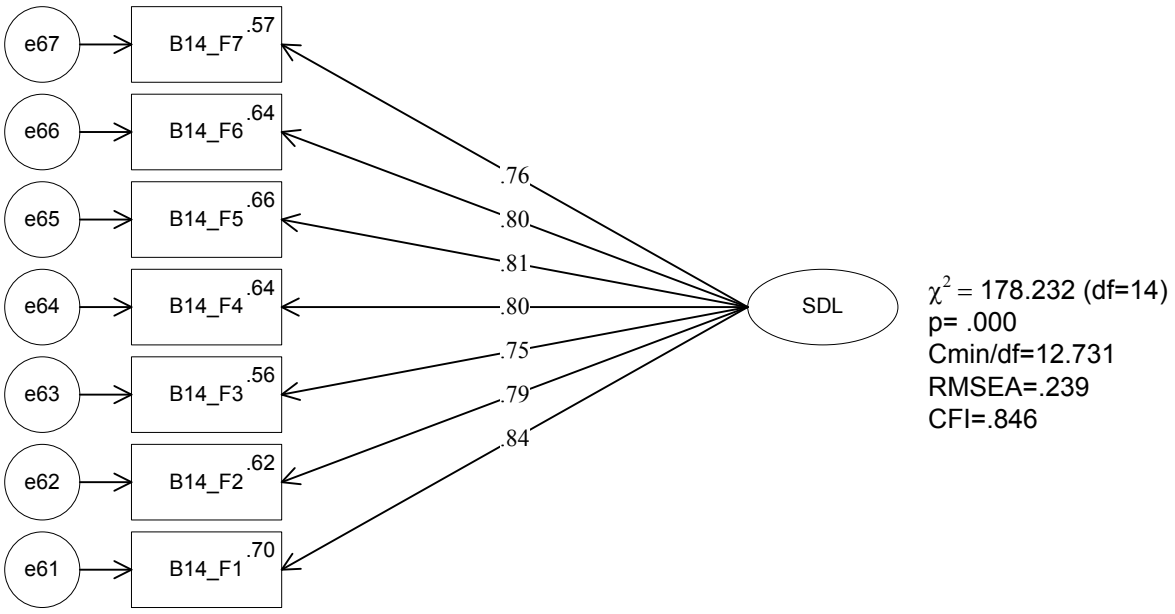



Figure 5.10 First model of Self-directed learning

Table 5.13
Modification indices for Self-directed learning

| Covariances | M.I. |
|---|---|
| Model 1 | |
| e66- e67 | 84 .672 |
| e61- e62 | 56 .495 |
| Model 4 | |
| e65- e66 | 11 .296 |

The fit statistics for model two improved with $\chi^2$ (12, $N$ = 207) = 31.952, $p$ = .001, RMSEA = .090 and CFI = .981. The CFI was sufficient for a good model by Hair et.al. (2010). However, the RMSEA was still above recommended value. Because the modification index showed no further suggested modification, it was decided to reduce the indicators. Reducing the indicators of a model will improve the fit statistics better than respecification based on modification indices (Brown, 2006).

In Model 3 item with the lowest factor loading, B14_F7 "Students self-assess their learning outcome", was not included. The fit statistics improved with $\chi^2$ (8, $N$ = 207) = 28.830, $p$ = .00, RMSEA = .112 and CFI = .975. The RMSEA of Model 3 was still below the requirement. The result of the modification indices was checked again to improve the goodness of fit in Model 4.

The result of modification indices suggested setting a covariance path between e65 and e66. The fit statistics were improved with $\chi^2$ (7, $N$ = 207) = 14.483, $p$ = .043, RMSEA = .072 and CFI = .991. This results met the requirement of a good model fit by Hair and colleagues' (2010), therefore Model 4 (Figure 5.11) was used as the final model of the Self-directed learning.

The complete steps of the model modification and the fit statistics changes are presented in Table 5.14. The final indicators of Self-directed learning can be seen in Table 5.15.

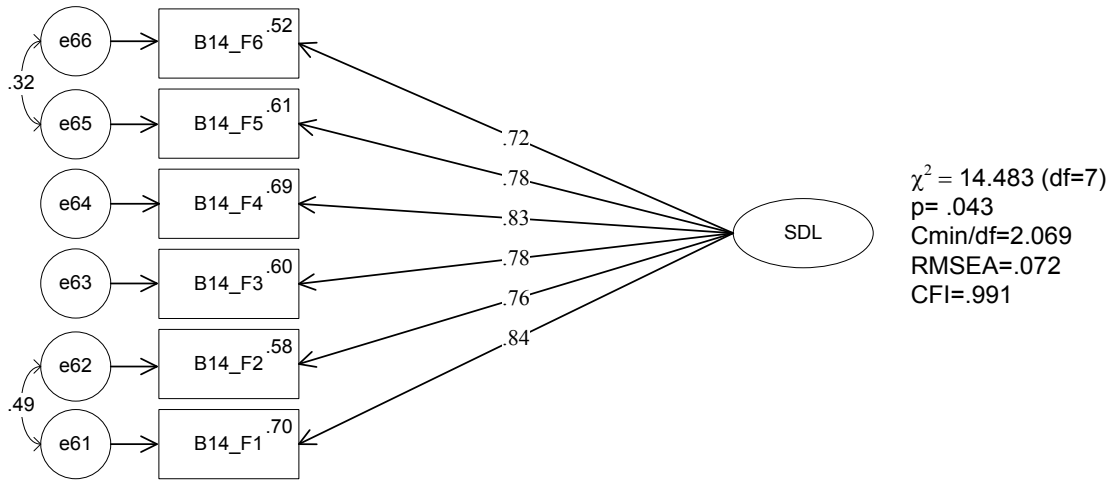



Figure 5.11 Final model of Self-directed learning

Table 5.14
Analysis steps of Self-directed learning

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 178.232 | 14 | 12.731 | .000 | .239 | .846 | |
| 2 | 31.952 | 12 | 2.663 | .001 | .090 | .981 | Covariance path: e61-62; e66-e67 |
| 3 | 28.830 | 8 | 3.604 | .000 | .112 | .975 | B14_F7 removed |
| 4 | 14.483 | 7 | 2.069 | .043 | .072 | .991 | Covariance path: e65-e66 |

Table 5.15
Final indicators of Self-directed learning

| Variable | Indicators |
|---|---|
| B14_F1 | Students take initiative in diagnosing their learning needs |
| B14_F2 | Students formulating the learning goals |
| B14_F3 | Students decide the resources (human and material) for learning |
| B14_F4 | Students choose appropriate learning strategies |
| B14_F5 | Students evaluate the accuracy and value of the resources |
| B14_F6 | Students self-monitor their learning progress |

### 5.1.7 Measurement model of Problem-based learning implementation

The preceding sections of this chapter have shown the development of the individual construct of each factor measuring PBL implementation. This section depicts the measurement model of PBL implementation (i.e. a CFA model of PBL questionnaire).

The measurement model of the PBL questionnaire was based on the individual construct of each factor described in the previous sections: Student-centred learning (Figure 5.2), Small-group (Figure 5.4), Problem as stimulus (Figure 5.6), Real-world problem (Figure 5.7), Teacher as facilitator (Figure 5.9), and Self-directed learning (Figure 5.11). Table 5.16 lists the final indicators of PBL implementation.

When the measurement model of PBL implementation (Model 1) was fitted to the data (Figure 5.12), the following fit indices resulted: $\chi^2$ (384, $N$ = 207) = 713.564, $p$ = .000, RMSEA = .065, CFI = .923. This result met the requirement of a good model fit (Hair, et al., 2010). Model 1 consisted of 30 observed variables with $N$ = 207. For a model with 30 or more observed variables and $N$ < 250, the suggested GOF thresholds are: CFI ≥ .92 and RMSEA < .08 (Hair, et al., 2010). Therefore, this model was used as the final measurement model of the PBL questionnaire. The complete fit indices of the model are presented in Table 5.17.

Table 5.16
Final indicators of PBL questionnaire

| Indicators | Variable |
|---|---|
| Student-centred learning | |
| Students are responsible for their own learning | B14_A1 |
| Students are actively involved in the process of learning | B14_A2 |
| Students have autonomy in the process of learning | B14_A3 |
| Small group | |
| The group size is appropriate to stimulate group discussion | B14_B2 |
| The learning groups have positive atmosphere (non-threatening) | B14_B3 |
| The group size is appropriate to encourage active student participation | B14_B4 |
| Problem as stimulus | |
| The problems in the tutorial process | |
| …match with students' level of knowledge | B14_C1 |
| …stimulate thinking, analysis, and reasoning | B14_C2 |
| …assure self-directed learning | B14_C3 |
| …activate students' prior knowledge | B14_C4 |
| …lead to the discovery of the learning objectives | B14_C5 |
| …arouse students' curiosity | B14_C6 |

(Table 5.16 continues)

(Table 5.16 continued)

| Indicators | Variable |
|---|---|
| Real-world problems | |
| The problems in the tutorial process | |
| …are realistic | B14_D1 |
| …are clinically relevant | B14_D2 |
| …related to a public health topic | B14_D3 |
| …generate multiple hypotheses about their cause and solution | B14_D4 |
| Teacher as facilitator | |
| The tutors have a clear picture about their strengths/weaknesses as a tutor | B14_E1 |
| The tutors are clearly motivated to fulfill their role as a tutor | B14_E2 |
| The tutors stimulate the students | |
| …to summarize what they had learnt in their own words | B14_E3 |
| …to search for links between issues discussed in the tutorial group | B14_E4 |
| …to understand underlying mechanisms/theories | B14_E5 |
| …to apply knowledge to other situations/problems | B14_E7 |
| …to give constructive feedback about the group work | B14_E8 |
| …to evaluate group co-operation regularly | B14_E9 |
| Self-directed learning | |
| Students take initiative in diagnosing their learning needs | B14_F1 |
| Students formulating the learning goals | B14_F2 |
| Students decide the resources (human and material) for learning | B14_F3 |
| Students choose appropriate learning strategies | B14_F4 |
| Students evaluate the accuracy and value of the resources | B14_F5 |
| Students self-monitor their learning progress | B14_F6 |

Table 5.17
Fit indices of PBL measurement model

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 713.564 | 384 | 1.858 | .000 | .065 | .923 | - |

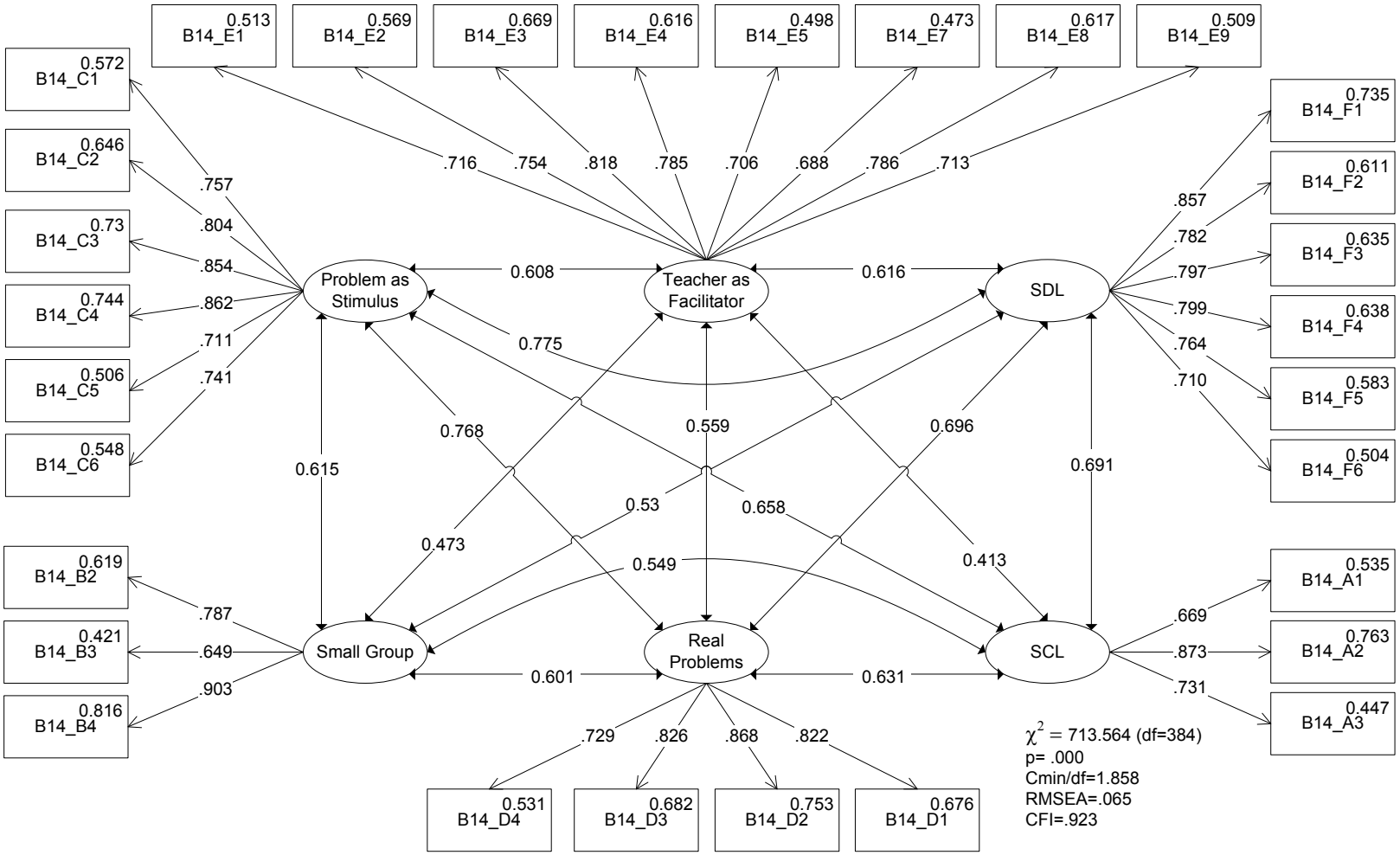



Figure 5.12 Final measurement model of PBL implementation

Note. The measurement errors are omitted to reduce the complexity of the model diagram.

Table 5.18 provides the result summary of the validity and reliability process based on confirmatory factor analysis. The result provided evidences that the PBL questionnaire is valid and reliable.

Table 5.18
Construct validity of PBL implementation questionnaire

| | CR | AVE |
|---|---|---|
| Student-centred learning | 0.804 | 0.581 |
| Problem as stimulus | 0.908 | 0.624 |
| Real-world problem | 0.886 | 0.661 |
| Teacher as facilitator | 0.910 | 0.558 |
| Self-directed learning | 0.906 | 0.618 |
| Small group | 0.827 | 0.619 |

*Note*. CR: Construct Reliability. AVE: Average Variance Extracted.

#### 5.1.7.1 Convergent validity

Hair, et al. (2010) stated that the requirements to assure convergent validity are: (1) the standardized loading estimate (factor loading) is at least .5 and ideally .7 or higher; (2) average variance extracted (AVE) should be .5 or higher; and (3) construct reliability (CR) should be .7 or higher.

As can be seen in Figure 5.12 the final measurement model showed that PBL mostly has ideal factor loadings. Only three factor loadings were below .7 (B14_B3, B14_E7, and B14_A1), however still above the minimum value (.5). This means that each item variance in PBL implementation was explained more by a specific latent construct than by the error measurement.

The AVE was calculated with Equation 3.2 (Section 3.4.3.1, page 70). As can be seen in Table 5.18, all AVEs are above .5. The values ranged from .581 (Student-centred learning) to .661 (Real-world problems) (Table 5.18). This indicates that the indicators' variances are explained more by the latent construct rather than by the error of item.

The construct reliability (CR) was calculated with Equation 3.3 (Section 3.4.3.1 page 70). The CR values were above the suggested level of .7 (Hair, et al., 2010). The CR values were ranging from .804 (Student-centred learning) to .906 (Self-directed learning). This means PBL

implementation is internally consistent; the indicators in each factor consistently represent the same latent construct.

#### 5.1.7.2 Discriminant validity

As indicated earlier in Chapter 3 (Section 3.4.3.1), to assure the discriminant validity of a scale, the average variance extracted (AVE) should be greater than the squared interconstruct correlation (Fornell & Larcker, 1981). For example, in this study the AVE of Student-centred learning (SCL) and the AVE of Self-directed learning (SDL) should be higher than the squared correlation between SCL and SDL. Because this indicates that the indicators designed to measure SCL indeed measure SCL and not other construct (in this case SDL).

Table 5.19
Constructs variance and interconstructs correlation of PBL implementation questionnaire

| | (1) | (2) | (3) | (4) | (5) | (6) | AVE | ASV |
|---|---|---|---|---|---|---|---|---|
| (1) Student-centred learning | **0.762** | 0.433 | 0.398 | 0.171 | 0.477 | 0.301 | 0.581 | 0.356 |
| (2) Problem as stimulus | 0.658 | **0.790** | 0.590 | 0.370 | 0.601 | 0.378 | 0.624 | 0.474 |
| (3) Real-world problem | 0.631 | 0.768 | **0.813** | 0.312 | 0.484 | 0.361 | 0.661 | 0.429 |
| (4) Teacher as facilitator | 0.413 | 0.608 | 0.559 | **0.747** | 0.379 | 0.224 | 0.558 | 0.291 |
| (5) Self-directed learning | 0.691 | 0.775 | 0.696 | 0.616 | **0.786** | 0.281 | 0.618 | 0.445 |
| (6) Small group | 0.549 | 0.615 | 0.601 | 0.473 | 0.530 | **0.787** | 0.619 | 0.309 |

*Note*. Values below the diagonal are correlation among constructs. Diagonal values are construct variances. Values above the diagonal are squared correlations. (1) Student-centred learning. (2) Problem as stimulus. (3) Real-world problem. (4) Teacher as facilitator. (5) Self-directed learning. (6) Small group.

Table 5.19 indicates that the AVE of SCL (.581) is higher than the squared correlation between SCL and Problem as stimulus (.433); SCL and Real-world problem (.398); SCL and Teacher as facilitator (.171); SCL and SDL (.477); SCL and Small group (.301). This means the items in the SCL factor measure a specific construct which was not measured by other factors.

The other factors also showed a similar trend. All AVE values are higher than the value of interconstruct squared correlations. This means that all factors measured a specific construct. This indicates discriminant validity of the PBL implementation questionnaire.

Another way to show the evidence of discriminant validity is to use the average shared squared variance (ASV). Discriminant validity can be achieved when the AVE is greater than the ASV. The ASV was computed by averaging the interconstruct squared correlation, as indicated in Equation 3.4 (Section 3.4.3.1 page 71). For example, the ASV of SCL = (0.433 +

0.398 + 0.171 + 0.477 + 0.301)/5 = 0.356. Table 5.19 shows that the AVE values of all factors are higher than the ASV which indicates discriminant validity.

Additionally, the absence of factor cross-loading in the PBL measurement model also supports the discriminant validity of the PBL measurement model. Hair, et al. (2010) stated that a congeneric measurement model (no cross-loading) supports discriminant validity. Cross-loading is a condition where an indicator loads to more than one constructs. Figure 5.12 shows that all indicators load to only one factor.

## 5.2 Graduates' competencies

This section reports the development of individual constructs of graduates' competencies.

The data initially consisted of 225 graduates. The non-responses were excluded from the data set. This means that graduates who had 32 missing values in graduates' competencies questionnaire (fail to fill all indicators) were excluded from the analysis. After removing the non-response, the data consisted of 181 graduates and still contained few missing values (.19%). Imputation method (mean substitution) was applied to the rest of the missing values. This was done with series mean method in SPSS.

In the final analysis, PBL factors were used simultaneously as an independent variable, therefore it was necessary to assess the measurement model. In the case of graduates' competencies, the final analysis used only one specific graduates' competencies factor as a dependent variable. Therefore, the measurement model for graduates' competencies is not necessary. The consequences for the organisation of this section are: (1) there is no measurement model section, and (2) the evidences of convergent validity (i.e. Construct Reliability (CR) and Average Variance Extracted (AVE)) are reported in each individual construct – instead of in separate section as in the PBL section.

As mentioned before in Chapter 3 (Section 3.2.3) the competencies factor was developed from the result of exploratory factor analysis and the factor naming was based on prior researches in graduates' competencies. The following sections reviewed each individual construct of graduates' competencies: Personal and organisational competencies, Leadership, Field-related competencies, and Interpersonal competencies.

### 5.2.1 Personal and organisational competencies

The Personal and organisational model used the items described in Table 3.12. When the first model (Figure 5.13) was fitted to the data, the following fit indices resulted: $\chi^2$ (27, $N$ = 181) = 75.620, $p$ = .000, RMSEA = .10, CFI = .949. The RMSEA failed to fulfil the requirement of a good model fit by Hair and colleagues (2010).

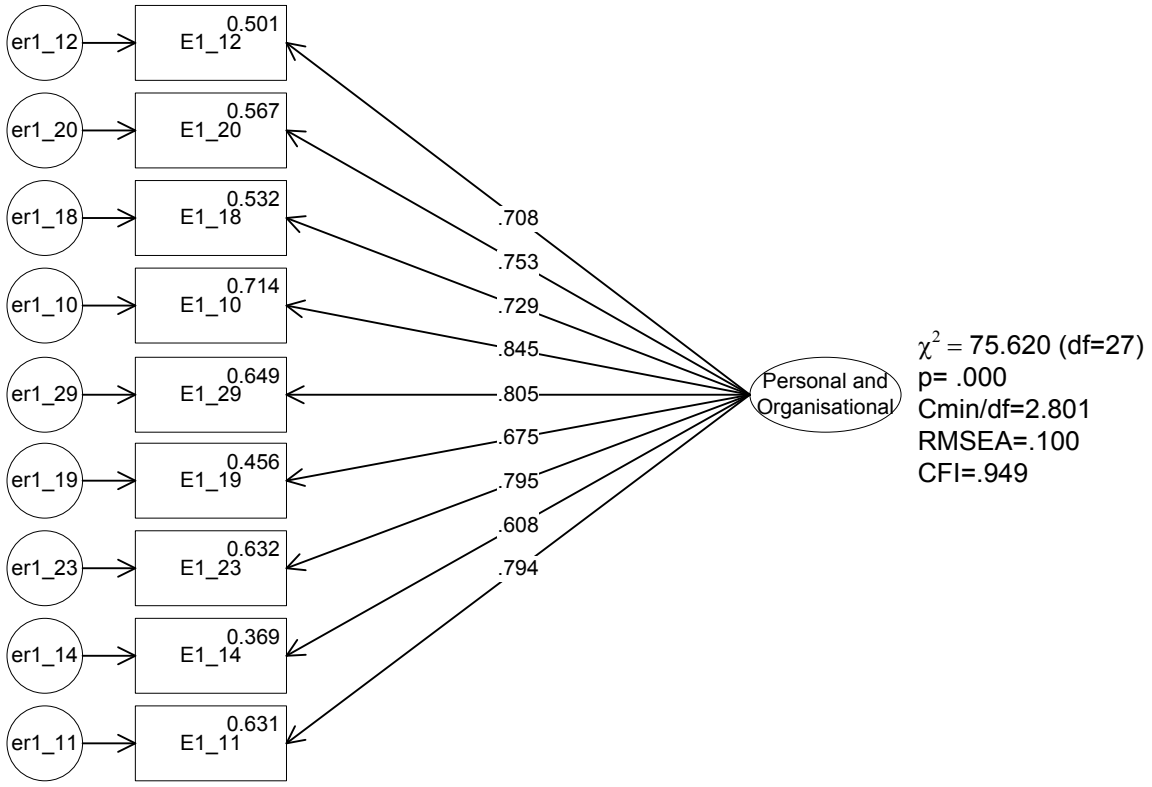



Figure 5.13 First model of Personal and organisational competencies

To improve the fit statistics the model was readjusted based on the result of modification indices. The modification indices suggested setting the covariance paths between the error measurements: er1_29-er1_18; er1_19-er1_23; er1_10-er1_11; er1_19-er1_11; and er1_18-er1_20. Table 5.20 shows the complete values of the modification indices.

Table 5.20
Modification indices for Personal and organisational competencies

| Covariances | M.I. |
|---|---|
| Model 2 | |
| er1_29 - er1_18 | 11.575 |
| er1_19 - er1_23 | 10.565 |
| er1_10 - er1_11 | 9.444 |
| er1_19 - er1_11 | 6.933 |
| er1_18 - er1_20 | 5.342 |

Fit indices for Model 2 improved with $\chi^2$ (22, $N$ = 181) = 32.132, $p$ = .075, RMSEA = .051, CFI = .989. Table 5.21 shows the improvement of the fit statistics from the first to the second model. Model 2 (Figure 5.14) met the requirement of a good model fit by Hair and colleagues (2010) therefore it was accepted as the final model of Personal and organisational competencies.

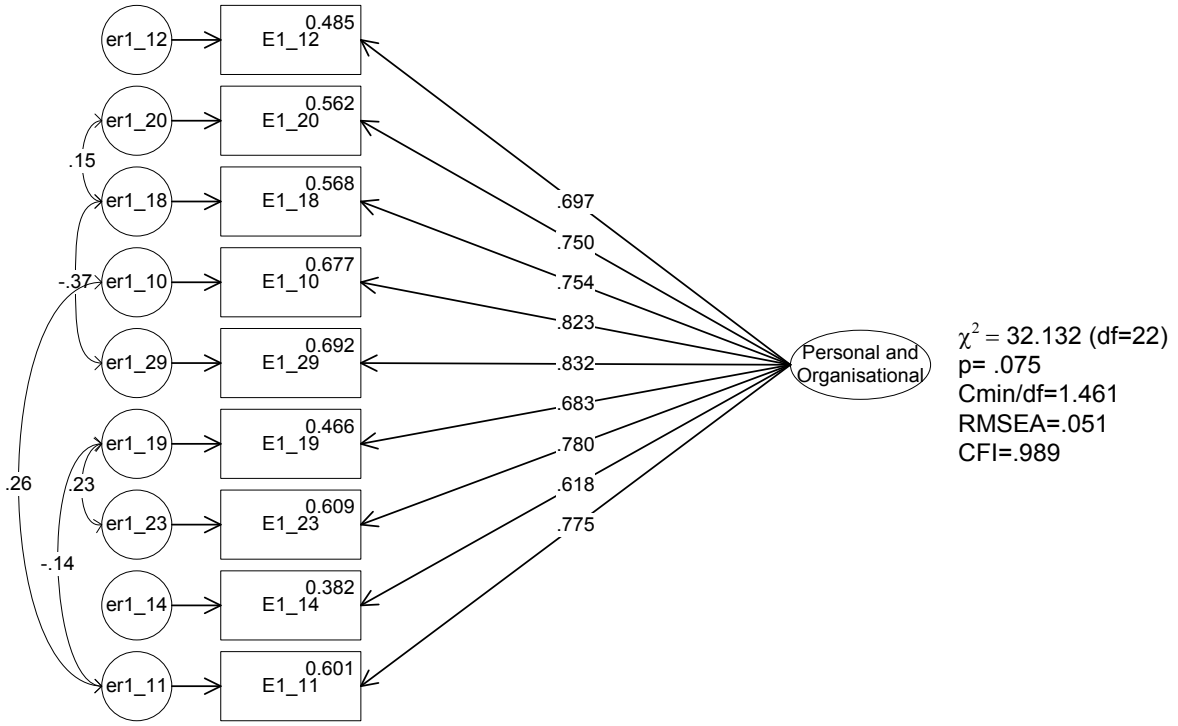



Figure 5.14 Final model of Personal and organisational competencies

Composite reliability (CR) and average variance extracted (AVE) were calculated to provide the evidence of convergent validity. CR was calculated with Equation 3.3 and AVE was calculated with Equation 3.2 (Section 3.4.3.1). The results of the calculation for Personal and organisational competencies were: CR = .92 and AVE = .56. Additionally the factor loadings

were all above .5. These results are sufficient for an evidence of convergent validity: factor loading above .5, CR above .70, AVE above .5 and CR is greater than AVE (Hair, et al., 2010).

The final indicators of Personal and organisational competencies can be seen in Table 5.22.

Table 5.21
Analysis steps of Personal and organisational competencies

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 75.620 | 27 | 2.801 | .000 | .100 | .949 | |
| 2 | 32.132 | 22 | 1.461 | .075 | .051 | .989 | Covariance path: er1_20-er1_18; er1_18 -er1_29; er1_10-er1_11; er1_19-er1_23; er1_19 - er1_11. |

Table 5.22
Final indicators of Personal and organisational competencies

| Variable | Indicators |
|---|---|
| E1_12 | Reflective thinking, assessing one's own work |
| E1_20 | Initiative |
| E1_18 | Working independently |
| E1_10 | Problem-solving ability |
| E1_29 | Taking responsibilities, decisions |
| E1_19 | Working in a team |
| E1_23 | Loyalty, integrity |
| E1_14 | Working under pressure |
| E1_11 | Analytical competencies |

### 5.2.2 Leadership

Leadership model used the items described in Table 3.12. When the first model (Figure 5.15) was fitted to the data, the following fit indices resulted: $\chi^2$ (20, *N* =181) = 48.599, *p* = .000, RMSEA = .089, CFI = .960. The RMSEA failed to fulfil the requirement of a good model.

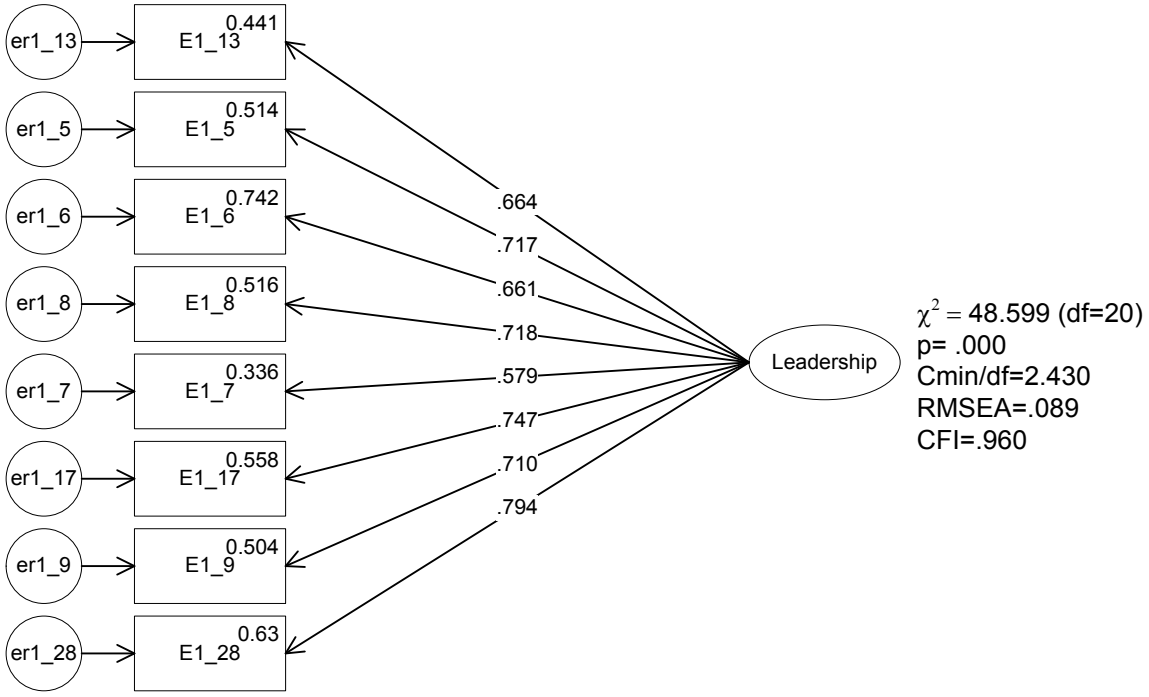



Figure 5.15 First model of Leadership

The model was respecified based on the result of modification indices. Two covariance paths were added to the model: a covariance between: er1_8-er1_28; and er1_6-er1_17. Table 5.23 shows the highest values of the modification indices.

The modification yielded a better model fit: $\chi^2$ (18, $N$ = 181) = 34.520, $p$ = .011, RMSEA = .071, CFI = .977. This model was accepted as the final model of Leadership (Figure 5.16).

Table 5.23
Modification indices of Leadership

| Covariances | M.I. |
|---|---|
| Model 1 | |
| er1_8 - er1_28 | 6,575 |
| er1_6 - er1_17 | 5,385 |

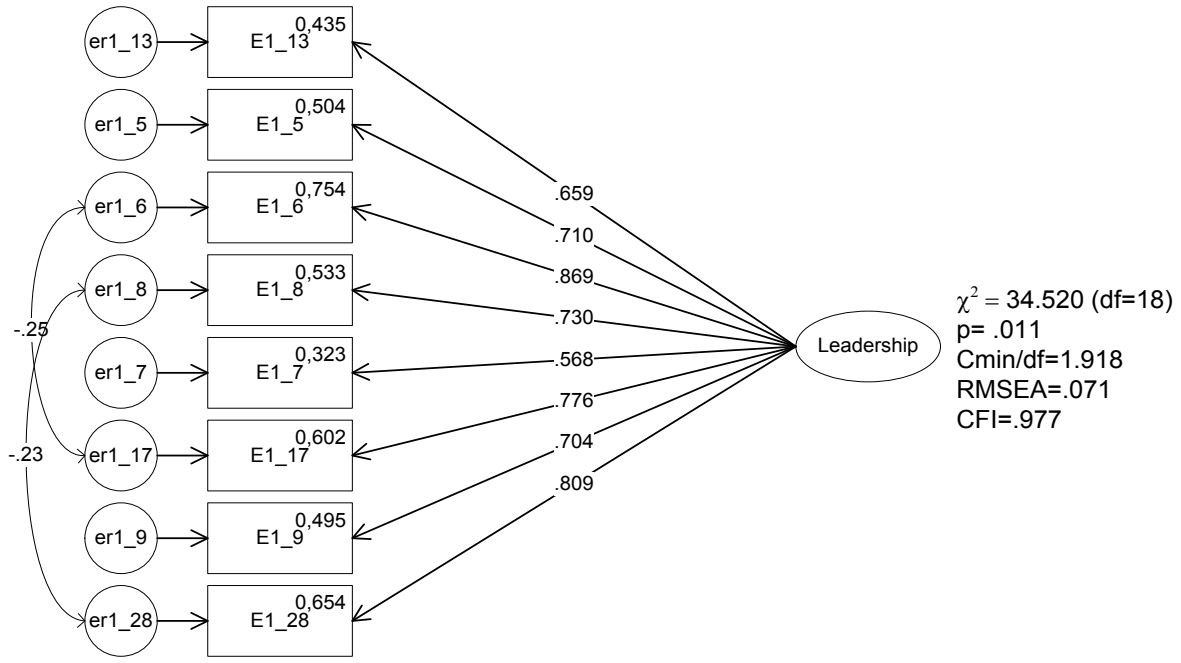



Figure 5.16 Final model of Leadership

The evidence of convergent validity of the Leadership factor can be inferred from the result of CR and AVE (.90 and .54 respectively) and all factor loadings are above .5. Table 5.24 depicts the complete fit indices for the first and second model. The final indicators of Leadership can be seen in Table 5.25.

Table 5.24
Analysis steps of Leadership

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 48.599 | 20 | 2.430 | .000 | .089 | .960 | |
| 2 | 34.520 | 18 | 1.918 | .011 | .071 | .977 | Covariance paths: er1_6-er1_17; er1_8-er1_28 |

Table 5.25
Final indicators of Leadership

| Variable | Indicators |
|---|---|
| E1_5 | Understanding complex social, organisational and technical systems |
| E1_6 | Planning, co-ordinating and organising |
| E1_8 | Economic reasoning |
| E1_7 | Applying rules and regulations |
| E1_17 | Negotiating |
| E1_9 | Documenting ideas and information |
| E1_28 | Leadership |
| E1_13 | Creativity |

### 5.2.3 Field-related competencies

The Field-related competencies model used the items described in Table 3.12. When the first model (Figure 5.17) was fitted to the data, the following fit indices resulted: $\chi^2$ (9, $N$ =181) = 92.006, $p$ = .000, RMSEA = .226, CFI = .840. The fit indices needed a few improvements for a good fit model.

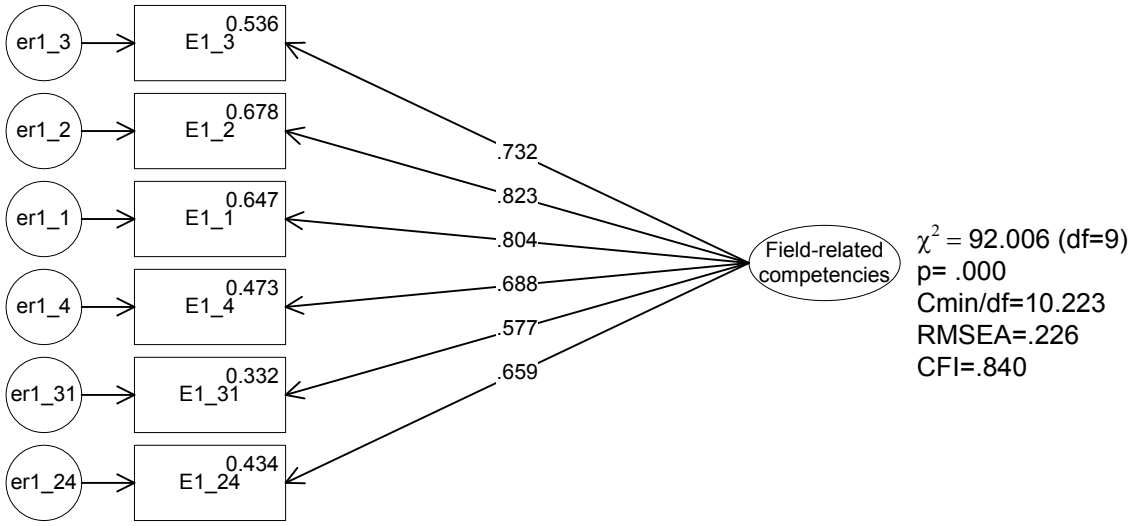



Figure 5.17 First model of Field related competencies

The model was readjusted based on the result of the modification indices. The result of modification indices for the first model (Table 5.26) suggested that the model could be improved by setting the covariance path between: er1_31 - er1_24; er1_4 - er1_3; and er1_2- er1_31.

Table 5.26
Modification indices of Field-related competencies

| Covariances | M.I. |
|---|---|
| Model 1 | |
| er1_31- er1_24 | 38.416 |
| er1_4 - er1_3 | 21.776 |
| er1_2 - er1_31 | 15.180 |

The fit statistics for model two significantly improved with $\chi^2$ (6, $N$ = 181) = 6.376, $p$ = .382, RMSEA = .019, CFI = .999. Table 5.27 depicts the complete improvement of fit statistics from Model 1 to Model 2. The final indicators of Field-related competencies can be seen in Table 5.28.

Model 2 (Figure 5.18) met the requirement of a good model fit (Hair, et al., 2010), therefore it was accepted as the final model of Field related competencies.

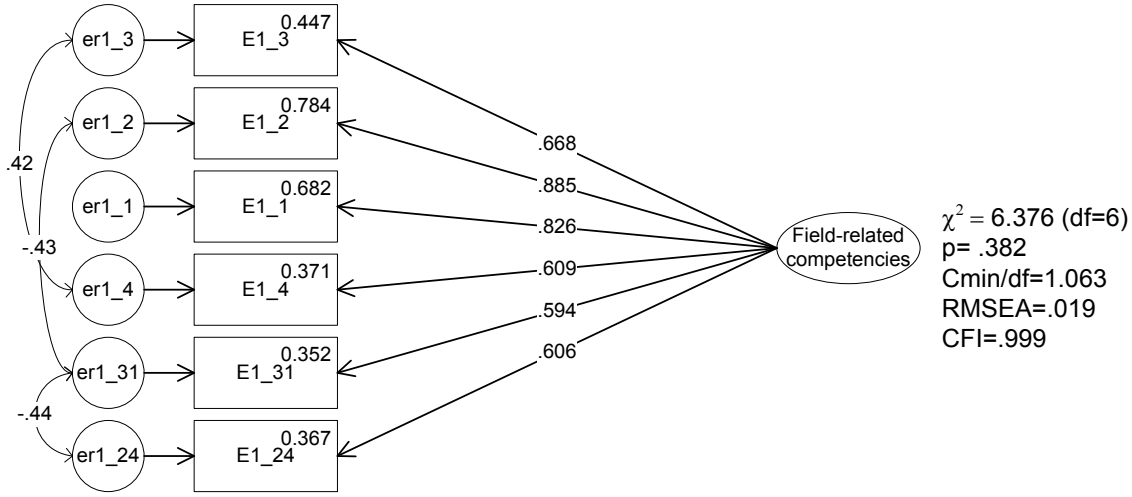



Figure 5.18 Final model of Field-related competencies

The evidence of convergent validity of field-related competencies can be inferred from the result of CR and AVE (.85 and .50 respectively) and the factor loadings (all above .5). Table 5.27 shows the complete fit indices for the first and second model of Field-related competencies. The final indicators of Field-related competencies can be seen in Table 5.28.

Table 5.27
Analysis steps of Field-related competencies

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 92.006 | 9 | 10.223 | .000 | .226 | .840 | |
| 2 | 6.376 | 6 | 1.063 | .382 | .019 | .999 | Covariance paths: er1_31- er1_24; er1_4-er1_3; er1_2-er1_31 |

Table 5.28
Final indicators of Field-related competencies

| Variable | Indicators |
|---|---|
| E1_3 | Field-specific theoretical knowledge |
| E1_2 | Cross-disciplinary thinking/knowledge |
| E1_1 | Broad general knowledge |
| E1_4 | Field-specific knowledge of methods |
| E1_31 | Self-directed learning skills |
| E1_24 | Critical thinking |

### 5.2.4 Interpersonal competencies

The Interpersonal competencies construct used the items described in Table 3.12. When the first model was fitted to the data, the following fit indices resulted: $\chi^2$ (9, $N$ = 181) = 12.152, $p$ = .205, RMSEA = .044, CFI = .992. These fit indices are already sufficient for a good model as suggested by Hair et al. (2010). However, the model still failed to indicate convergent validity.

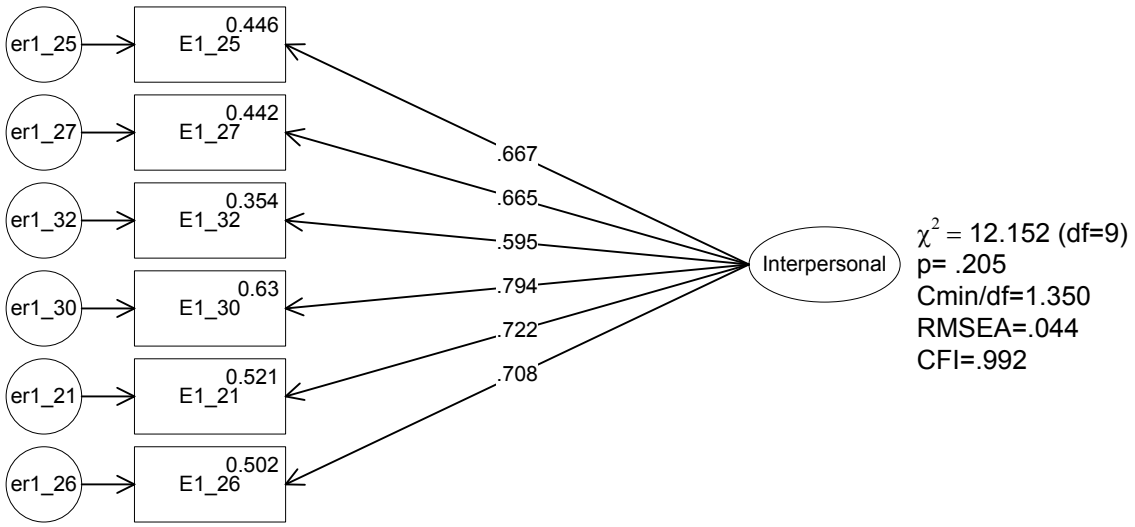



Figure 5.19 First model of Interpersonal competencies

The proof of convergent validity of Interpersonal competencies was reflected in the result of factor loadings (all above .5), the CR and the AVE (.84 and .48 respectively). However, the AVE was still below the suggested level of .5.

To improve the convergent validity, the indicator with the lowest factor loading (E1_32 "Coping with uncertainty") was removed from the model. After removing E1_32, the AVE of Interpersonal competencies was improved (.508) and sufficient to indicate convergent validity.

The GOF was slightly reduced, however the values were still satisfactory for a good model, $\chi^2$ (5, $N$ = 181) = 8.99, $p$ = .109, RMSEA = .067, CFI = .987. Therefore Model 2 (Figure 5.20) was accepted as the final model of Interpersonal competencies. The complete fit statistics can be seen in Table 5.29.

The final indicators of Interpersonal competencies can be seen in Table 5.30.

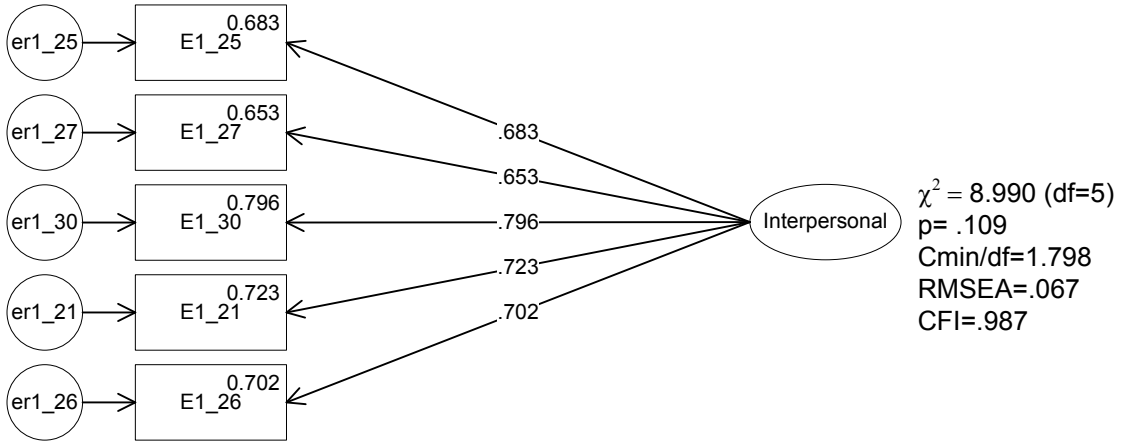



Figure 5.20 Final model of Interpersonal competencies

Table 5.29
Analysis steps of Interpersonal competencies

| Model | $\chi^2$ | *df* | $\chi^2$ /*df* | *p* | RMSEA | CFI | Changes |
|---|---|---|---|---|---|---|---|
| 1 | 12.152 | 9 | 1.350 | .205 | .044 | .992 | - |
| 2 | 8.990 | 5 | 1.798 | .109 | .067 | .987 | E1_32 removed |

Table 5.30
Final indicators of Interpersonal competencies

| Variable | Indicators |
|---|---|
| E1_27 | Tolerance, appreciating different points of view |
| E1_30 | Collaboration skills |
| E1_21 | Adaptability |
| E1_26 | Written communication skills |
| E1_25 | Oral communication skills |

## 5.3 Discussion

There are three issues that need further elaboration in this section: the factor with three indicators and the correlated measurement errors.

### 5.3.1 Factor with three indicators

In this study there are two factors with three indicators: Student-centred learning and Small group factor. A three-indicator model by nature will lead to a perfect fit. This happens because there are just enough degrees of freedom to estimate all the parameters (*df* = 0) (Hair,

et al., 2010). In terms of degree of identification, a three-item indicator model is called *just-identified* model (see Section 3.4.1.3 for further explanation about degree of identification).

Hair et al. (2010) further explained that just-identified models do not test a theory because their fit is determined by the circumstance. However, a model with three-indicator factors is acceptable, particularly when other factors have more than three indicators.

In this study the three-indicator factors were acceptable because the measurement model includes other factors which consist of more than three indicators, i.e. Problem as stimulus (six indicators), Real-world problems (four indicators), Teacher as facilitator (eight indicators), and Self-directed learning (six indicators).

Brown (2006) added that although goodness-of-fit does not apply in a just-identified model, the model can still be evaluated in terms of the interpretability and strength of its parameter estimates (e.g. magnitude of factor loading). In this study, the questionnaire was sent to be reviewed by PBL and methodology experts. The experts' agreements on the questionnaire provided sufficient evidence of a good interpretability. Additionally, the factor loadings of Student-centred learning (.71, .92, and .63) and Small-group (.75, .60, and .97) were all satisfactory.

### 5.3.2 Correlated measurement errors

In model re-specification based on modification indices, it is common to establish a correlation path between the measurement errors. This procedure leads to a better fit of the model (see again model re-specification in Section 3.4.1.5). This method was used in this study for several factors: Teacher as facilitator (Figure 5.9), Self-directed learning (Figure 5.11), Personal and organisational competencies (Figure 5.14), Leadership (Figure 5.16), and Field-related competencies (Figure 5.18).

Jöreskog (1993) suggested that in cross-sectional studies, the error should be uncorrelated from one indicator to another. If the error terms for two or more indicators correlate this means that these indicators measure other constructs or something in addition to the construct the indicator is intended to measure (Jöreskog, 1993).

The logic of this concept can be explained more clearly with a three item model, see Figure 3.3 (page 63) for the visual diagram. Suppose a construct ($\xi_1$) has three indicators (X1, X2,

and X3). The relation of X1 with X2 or X3 ideally should be only based on the underlying construct ($\xi_1$). In other words, they should be correlated because they measure the same construct. If the construct ($\xi_1$) is deleted then there should be no relation between X1, X2, and X3. If, for example, the error measurement of X1 ($\delta_1$) and X2 ($\delta_2$) is correlated then one might suspected that X1 and X2 also measure other constructs besides $\xi_1$. In a panel study this is acceptable because the shared variance between the indicators might come from prior measurement effect (Jöreskog, 1993).

However, intercorrelated measurement error is also common in cross-sectional study and it can be justified based on source or *method effects*. Method effects exist when the measurement approach causes the differential covariance among items, rather than the substantive latent factors (Brown, 2006). Podsakoff (2003) pointed out several sources of method effects. Some possible method effects related to this study were the *scale format* and *scale anchor*, the *similar item wording*, and *social desirability*.

Scale format and anchor are related to the use of standardized rating (Podsakoff, et al., 2003). In this study most of the questions used a similar scale format, semantic differential style with similar scale anchors or values. The graduates' competencies and PBL questionnaire used the same anchor, from 1 "Not at all" to 5 "To a very high extent". The use of standardized format and anchor require less cognitive processing. Therefore, it is easier for the respondents to complete. However, the consistency in the scale may have an effect to the covariance in the construct rather than the content of the item (Podsakoff, et al., 2003). In this case graduates might give a repetitive response and disregard the content of the questionnaire.

Acquiescence responses increase the correlation among items with *similar wording*, even when the content of the item is different (Podsakoff, et al., 2003). Acquiescence response set is the tendency of respondents to agree/disagree with the statement regardless of the content (Winkler et al. as cited in Podsakoff, et al., 2003). Unfortunately, sometimes using similar wording in item development is inevitable since the items are representing the same construct. In this study, item similarity can be found in the indicators of Field-related competencies. Item E1_3 (Field-specific theoretical knowledge) and E1_4 (Field-specific knowledge of methods) have similar wording. This leads to the existence of a relationship

between the two variables which is reflected by the correlated error measurement (see Figure 5.18).

Social desirability may be viewed as a tendency to respond in culturally acceptable and appropriate manner. Additionally, it can be viewed as a property of the items in a questionnaire. Respondents perceived items with high social desirability as correlating with each other because of the similar level of social desirability rather than their content (Podsakoff, et al., 2003). This could explain the correlated error measurement in this study, for example for Teacher as facilitator factor in the PBL questionnaire. Item B14_E1 (The tutors have a clear picture about their strengths/weaknesses as a tutor) and B14_E2 (The tutors are clearly motivated to fulfil their role as a tutor) were suspected to have similar level of social desirability than other items because of their content. This was the possible cause of their correlated error.

Besides the method effects reasons, in this study the correlated error is not a problem because the variance of most items came from the latent construct rather than from the error measurement. This was shown by the factor loading of most items which were higher than .70, and the AVE values were higher than .5. Therefore, although the measurement errors were correlated, which was an indicator of the existence of an unknown construct, the items variance majority still came from the latent factor, not the unknown construct (measurement error).

Additionally, the correlated error existed within a factor. There are no inter-factor correlated errors. Thus, the correlated error did not violate the model's underlying theory.

### 5.3.3 Respecification to improve the interpretation of a model

Usually having the best goodness-of-fit (GOF) values is the goal of structural model development. However, this is not always the case. Sometimes having the best GOF is not the best solution for a model especially in a confirmatory model. This can be seen in the result of Interpersonal competencies individual construct model (see section 5.2.4). The first model of Interpersonal competencies already had sufficient GOF (Table 5.29). However the value of average variance extracted (AVE) was still below the suggested level (.5), which indicated a convergent validity problem.

To improve the AVE, item with the lowest factor loading (E1_32 "Coping with uncertainty") was excluded in the next model. This resulted to an acceptable AVE values (.508).

This process is often mentioned as respecification to improve the interpretation of a model (Brown, 2006). This kind of respecifitation does not improve the GOF of the model; in fact it may worsen the GOF in most cases (Brown, 2006). The exclusion of item E1_32 worsens the model fit of Interpersonal competencies, RMSEA was increased from .044 to .067 and CFI was decreased from .992 to .987 (Table 5.29). However the values still fulfil the requirement of a good model fit.

The exclusion of item E1_32 was necessary to assure the convergent validity, which affected construct validity of the model. Hair, et al. (2010) stated that model validity not only depends on establishing acceptable levels of GOF, but also on providing evidence of construct validity (Hair, et al., 2010).

## 5.4 Summary

The purpose of this chapter was to report the validity and reliability of the instrument used in this study. The results of confirmatory factor analysis (CFA) were presented to achieve that purpose. CFA is a type of structural equation modelling which is usually used to assess the latent structure of an instrument (e.g. a questionnaire).

The results of CFA demonstrated that all individual constructs of PBL and graduates' competencies had acceptable goodness-of-fit (GOF). The GOF of the PBL measurement model was also sufficient for a good model. This means that all structural models reported in this chapter fulfilled the requirement of a good model fit. Thus, the theoretical model fits the data well.

Measurement model validity does not only depend on establishing GOF, but also on providing evidence of construct validity (Hair, et al., 2010). Therefore, besides the GOF, this chapter also reported the evidence of construct validity.

Construct validity consists of two parts: convergent and discriminant validity. The evidence of convergent validity was shown by the values of standardized loading estimate (factor loading), the average variance extracted (AVE), and the construct reliability (CR). All values

supported the evidence of convergent validity, which means that the indicators in each factor measured the same construct.

The evidence of discriminant validity was shown by the comparison of the AVE and the squared interconstruct correlation. All AVEs in the PBL questionnaire were greater than the squared interconstruct correlation. Additionally, there was no cross-loading factor, each indicator loaded only to one factor. These evidences indicated that each factor measured a specific construct, a unique construct that was not measured by other factors.

Based on these findings, it can be concluded that the questionnaires are valid and reliable and suitable for evaluation purposes. The questionnaire can be used to measure the implementation of PBL and graduates' competencies.

These findings fulfilled one objective of this study which was to identify each component of the PBL process (i.e. Student-centred learning, Small group, Teacher as facilitator, Problem as stimulus, Real-world problem and Self-directed learning). This identification is important to differentiate the difference between PBL and other methods and also to differentiate between various PBL interpretations. Furthermore, the identification of PBL components is an important foundation in analysing the effects of PBL on graduates' competencies, which will be discussed in Chapter 6.

# 6 The effects of PBL on graduates' competencies

Previously in Chapter 5, the development of the Problem-based learning (PBL) and graduates' competencies questionnaires were discussed. The results of confirmatory factor analysis (CFA) provided evidence of both questionnaires' validity and reliability. Chapter 6 brings together PBL implementation and graduates' competencies constructs into structural models to investigate the effect of PBL components on graduates' competencies.

As stated before in Chapter 1, implementing PBL as a whole system is costly (Albanese & Mitchell, 1993; Berkson, 1993; Finucane, et al., 2009). One of the major costs is providing infrastructure to support small classes. PBL requires the learning process to happen in small-groups. Another cost comes from the operational costs of tutoring. In PBL, Higher education institutions (HEIs) have to employ tutors in order to facilitate the learning process. Another cost comes from the process of changing the HEI's system. PBL operates around modules while other methods operate based on credit-hour in semester time frame.

PBL implementation not only concerns a change in the teaching and learning process, but also concerns management and administrative changes. The cost of supporting the conditions of PBL such as the availability of text books, the non-print media, and the availability of experts for the source of individual study should also be considered. Also the cost of human resources development needs such as training for tutors, faculty members, and administrative staff. The process of change also has immaterial cost such as the stress of change among faculty member and students. There is also the possibility of resistance in faculty members that needed to be addressed.

However, the implementation of PBL in a less than curriculum-wide mode is more achievable in a broader context (Albanese, 2000). This means teachers implement PBL at the course level or higher education institutions implement a few components of PBL in their

curriculum. For this kind of implementation, investigation on the effectiveness of each PBL components is needed. The result of this study could be used as the guide for PBL implementation.

Before the main results are presented, the following sections discuss briefly the rationale of the analysis and the method of investigating the effects of PBL on graduates' competencies.

## 6.1 The importance of investigating the effects of PBL on graduates' competencies

Research on the effectiveness of PBL is highly relevant not only for policy makers and university managers but also for educators or teachers interested in implementing PBL. As stated earlier, implementing PBL as a whole system is costly (Albanese & Mitchell, 1993; Berkson, 2003; Finucane, et al., 2009). However, the implementation of PBL in a less than curriculum-wide mode is more achievable in a broader context (Albanese, 2000). Therefore there is a need to identify the components of PBL and their effect on particular educational outcomes (Hmelo-Silver, 2004; Newman, 2003). So far, however, there has been little research about this topic.

As mentioned in the introduction chapter, information about the effectiveness of PBL components is important as a guide for HEIs and educators to implement PBL. The information of the effectiveness of PBL components can help HEIs in the following ways:

1. Institutions can choose to implement specific PBL components which are suitable with their educational goals and at the same time match with their limited resources.
2. Educators who want to implement PBL in their courses can choose which PBL components are appropriate to the courses' context and the educational goals. This is particularly suitable for educators who want to implement PBL without the support of the institution.

The information on effectiveness can help HEIs to answer questions such as the following: If we (the HEI) want to implement PBL in our institution where should we begin? Which PBL component should we focus on? If our resources are limited what PBL components should

we exclude? If we want to improve specific competencies (e.g. interpersonal competencies) what PBL components should we focus on?

## 6.2 Methods to investigate the effects of predictors on outcome

The most common method to investigate the effects of predictors (independent variable) on outcomes (dependent variable) is regression or multiple regression analysis for predicting several predictors (Field, 2005). Another method, which is gaining momentum lately, is partial least square path modelling or PLS-PM.

In this study the effects of PBL on graduates' competencies were analyzed with structural equation modelling instead of factor score regression or PLS-PM. The following sections briefly discuss factor score regression and PLS-PM. The discussion is mainly about the difference of the methods and the reasons for using a structural model in this study. The presentation is mostly non technical.

### 6.2.1 Factor score regression

In multivariate analysis there is a need to materialize the latent variable. This means there is a need to develop a variable that would be the proxy of the latent variable. The latent variable exists only in theory and researchers can not measure it directly. However, researchers can develop the factor's indicators based on its underlying theory. The indicators then can be measured and each indicator represented by specific variable. For example, in this study, Self-directed learning (SDL) is a latent variable, therefore in the dataset a variable called SDL does not exist. However, there are six indicators which are intended to measure SDL (see Table 5.15). The problem arises when researchers want to relate the latent variable to another variable. In order to do this, one has to transform the indicators of a latent variable to a single observed variable. This is usually achieved by computing factor scores. The factor scores then will be used as the representative of the latent variable in further analysis (e.g. correlation, regression).

However, there are few concerns regarding using factor score as the proxy of latent variable. Factor scores are usually computed in two ways: by creating *refined factor scores* or *coarse*

*factor scores* (also referred as *non-refined* method) (Brown, 2006; DiStefano, et al., 2009). Coarse factor score is calculated by averaging or summing the indicators' raw score. Some variations of this *sum scores* method include: applying a cut-off value, using standardized variables and using weighted sum scores (DiStefano, et al., 2009).

The Coarse factor scores method is widely used because it is a simple approach and is easily conducted in a statistical program. However, researchers argue that this method may poorly represent the latent factor; for the example, factor score may be intercorrelated even when it is previously assumed uncorrelated (Glass & Maguire, 1966). Another concern is regarding the equal weight of each item regardless of the difference of loading value. This means that items with low loading value are treated equally with the higher loading one in the factor score (DiStefano, et al., 2009).

*Refined factor scores* relate to the multivariate analysis method (i.e. exploratory factor analysis). The factor scores are the combination of the common variance (variance shared between item and factor) and unique variance (specific variance of the indicator and the measurement error) (Brown, 2006; DiStefano, et al., 2009). A frequently used method for estimating refined factor scores is least square regression approach, although other methods are also available, e.g. the Bartlett method and Anderson-Rubin method (Brown, 2006; DiStefano, et al., 2009). Refined factor scores have less bias than coarse factor scores, and therefore are better as proxies for latent factors (Grice, 2001). However, refined factor scores also have their own measurement issues.

Factor scores computed from the common factor model are indeterminate in nature. Indeterminacy here means that for any single common factor, an infinite number of sets of scores can be derived that are equally consistent with the same factor loading (Brown, 2006; Grice, 2001). For example in Amos™ statistical software, the calculation of factor scores by default will produce 10 sets of factor scores. A researcher also can get more sets of factor scores if he/she wants to, because theoretically the number of factor scores is infinite. As a consequence, there will be difficulty in deciding which factor scores to use. Depending on the degree of the indeterminacy, the output of the analysis will vary because of choosing a different set of factor scores (Brown, 2006; Grice, 2001). For example, in this study one graduate with a high ranking in Leadership competencies –according to one set of factor

scores – could obtain a low ranking on the same common factor according to another set of factor scores. Indeed there are ways to evaluate factor scores: by using validity coefficients, univocality, and correlational accuracy (see Grice (2001) for more detail information). However, the calculation of factor score evaluation is complex and not supported by default in most statistical software.

### 6.2.2 Partial least square path modelling

When comparing structural equation modelling (SEM) with partial least square path modelling (PLS-PM), researchers usually call SEM by its refined name, CBSEM or covariance based structural equation modelling. This is due to the nature of PLS-PM which is still in the family of SEM however with a basic difference: PLS-PM uses a variance-based technique while SEM uses a covariance-based technique in its calculation (Henseler, Ringle, & Sinkovics, 2009). Therefore this section uses the term CBSEM instead of SEM.

PLS-PM is a component-based estimation method; it separately solves out the blocks of the measurement model then estimates the path coefficients in the structural model (Vinzi, Trinchera, & Amato, 2010). With this method PLS-PM better explains the residual variance of the latent variables, and therefore is considered more as an exploratory approach than as a confirmatory one (Vinzi, et al., 2010).

PLS-PM, as CBSEM, provides a framework for estimating causal models with latent variables and allows simultaneous equations with measurement errors (Henseler, et al., 2009). PLS-PM stems from Herman Wold's algorithm which is called NILES (nonlinear iterative least squares) (Tenenhaus, Vinzi, Chatelin, & Lauro, 2005). PLS-PM soon gained researcher attention because it needed fewer prerequisites than CBSEM in terms of the distributions, the sample size and the measurement scale (Henseler, et al., 2009; Vinzi, et al., 2010). That is why PLS-PM is also mentioned as soft modelling (Vinzi, et al., 2010). The fewer prerequisites are an attractive feature for researchers who fail to fulfil it in CBSEM. PLS-PM lately gained momentum, which can be seen from the development of the statistical programs designed to conduct the procedure, e.g. XLSTAT PLS-PM, LVPLS, SmartPLS, and R (plspm package).

Henseler (2009) summarized the characteristics of PLS-PM usually stated by researchers who use it:

- PLS-PM algorithm allows the unrestricted computation of cause-effect relationship models that employ both reflective and formative measurement models.
- PLS-PM can estimate models when the sample size is small.
- PLS-PM can estimate a very complex model (i.e. consisting of many latent and manifest variables).
- PLS-PM is methodologically advantageous to CBSEM whenever improper or non-convergent results are likely to occur.

### 6.2.3 Reasons for using structural models

#### 6.2.3.1 Structural model and factor scores regression

This study used structural equation modelling to analyze the effect of PBL on graduates' competencies. A Structural model has several advantages compared to using factor score regression. The main advantage relates to the factor score indeterminacy of common factor model.

In a structural model, indeterminacy of factor scores is not a problem because in the analysis factor scores are not calculated; instead it uses the latent factors themselves in the analysis (Brown, 2006). The latent factor already comprises the interrelation between the indicators, with other constructs and the measurement error.

Another advantage is that the measurement models can be tested prior to the structural model. Thus the poor fit in the structural model can be determined because of the relation of the dependent and independent variables and not because of the measurement models (Hair, et al., 2010). In this study each individual construct of PBL and graduates' competencies was tested first, as presented in Chapter 5. The measurement model of PBL also tested and indicated a valid and reliable measurement model. Therefore the fit or misfit of the model reported in this chapter can be assured because of the relation in the structural model and not because of the inaccuracy in the measurement models (PBL and graduates' competencies measurement).

#### 6.2.3.2 Structural model and PLS-PM

Considering the brief discussion about factor score regression and PLS-PM presented before, this study used structural equation modelling to investigate the effect of PBL on graduates' competencies. This was based on the following reasons.

PLS-PM is primary intended for causal-predictive analysis in situation of high complexity but low theoretical information (Jöreskog as cited in Henseler, et al., 2009). This study was indeed intended to investigate the effect of PBL on graduates' competencies which was also a causal-predictive analysis. However, this study was strictly based on theoretical ground or theory driven therefore it is more appropriate to use CBSEM. Additionally, Henseler et al. (2009) stated that PLS-PM is more appropriate for predictive application and CBSEM is more appropriate in causal modelling where prior theory is strong and further testing and development is the goal.

One of the reasons for the popularity of PLS-PM is because the prerequisite of the procedure is less strict than the CBSEM. PLS-PM requires no strong assumption relating to the distributions, sample size and the measurement scale (Tenenhaus, et al., 2005; Vinzi, et al., 2010). Therefore PLS-PM is usually used by researchers who had some issues regarding the properties of the data such as non normal distribution, small sample size, and categorical data. The present study had no problem fulfilling the assumption for CBSEM, i.e. data normality and interval scaling.

PLS-PM is usually used in analyses with small number of observations or subjects (Henseler, et al., 2009). In this study the sample used in the analysis was sufficient for CBSEM ($N$=210). For a model with seven constructs the suggested sample size is 150 (Hair, et al., 2010).

PLS-PM advantages rest on the possibility to employ a formative model, in addition to reflective model. CBSEM can also estimate a formative program, however the PLS-PM algorithm is better in estimating models which employ both reflective and formative measurement models (Henseler, et al., 2009). In this study all the structural models were in reflective mode therefore there was no need to use PLS-PM.

PLS-PM is usually used in complex models (Henseler, et al., 2009). In this study the model consisted of only maximum seven latent constructs and 39 observed variables. Therefore it was categorized as a simple model, and appropriate to be analyzed with CBSEM.

## 6.3 Goodness-of-fit vs. model interpretation

In this study the analysis of the effects of PBL on graduates' competencies were investigated using structural equation modelling. In most structural models, the researcher aims for the best fit of the model, i.e. the best value of goodness-of-fit (GOF). To achieve this researcher often has to modify the model to fit the data; this is called model respecification (see Section 3.4.1.5). However, this is not always the case. In this study the main aim was to know the effects of PBL components on each group of graduates' competencies and not the fit of the model. Therefore in this study the structural model of PBL and graduates' competencies were not modified to get the best GOF. Even though this method is less common than the usual method, it is the most appropriate method for this study. Experts in multivariate analysis also acknowledge this method.

Hair (2010) stated that there is no single correct ways to apply multivariate technique. In some cases, relationships are strictly specified and the objective is to confirm relationships. In other cases, the relationships are loosely recognized, and the objective is the discovery of the relationship. Hair (2010) further describes that the researcher is the one that must apply the multivariate technique in accordance with the research objectives.

In its basic tenet, the logic of analysis used in this study was in accordance with Brown's (2006) explanation on respecification of a model to improve its interpretation. Brown suggests a model respecification to improve the model's parsimony and interpretability, even though it often results in the reduction of the GOF (Brown, 2006). This means that if a researcher seeks interpretability of the model, then the value of GOF is secondary.

Browne and Cudeck (1993) observed that there is a conflict between two characteristic of a model: the interpretability and the goodness of fit. This conflict comes from the desire to have both characteristic in the tested model: a close fit and clearly understood model. A clearly understood model means there is no meaningless parameter and all parameters can be explained by the underlying theory. However, in order to improve the model fit there is a temptation to increase the number of parameters. The additional parameter is usually meaningless. Browne and Cudeck (1993) further stated that model selection has to be a subjective process involving the use of judgment. This suggestion is related to their view on fit indices, Browne and Cudeck (1993) stated that: "Fit indices should not be regarded as

measures of usefulness of a model. They contain some information about the lack of fit of a model, but none about plausability" (p. 157).

Bollen and Long (1993), as the editors of a prominent book *Testing structural equation models*, concluded that researchers do not always agree on the best way to assess model fit. However, researchers reached a consensus that the best guide to assessing model fit is a strong substantive theory (Bollen & Long, 1993). Hair (2010) also stated that the desire of a good fit should never compromise the theory being tested.

From researchers suggestions it can be concluded that even though model fit is important in assessing model, the substance or the interpretation of the model should be the main concern.

## 6.4 The effects of PBL on graduates' competencies

To investigate the effects of PBL on graduates' competencies, structural equation modelling was applied to the data collected in this study. The data consisted of 210 graduates from the Faculty of Medicine, Gadjah Mada University, Indonesia, from 2009 to 2011.

Missing data were treated with pairwise deletion. Listwise deletion was not implemented for this study because it resulted in the loss of considerable proportion of the sample. Imputation method (mean substitution) was applied to fill the missing data. The method was conducted in SPSS 20 (series-mean method). The percentage of missing data was 9.8%.

The investigation of the effects of PBL on graduates' competencies is divided into four units:

1. The effects of PBL on Personal and organisational competencies models
2. The effects of PBL on Field-related competencies models
3. The effects of PBL on Leadership models
4. The effects of PBL on Interpersonal competencies models

This study used *alternative models* (AM) method described by Jöreskog (1993). In this method the researcher specifies alternative models and, based on the analysis of a single set of data, one of the models will be selected. For each unit of the analysis there were two models tested. For example in the first unit of the analysis there were two models (Model 1A and Model 1B) to investigate the effect of PBL on personal and organizational competencies. In

Model 1A, the constrained parameters of PBL indicators were freed by adding covariance between them. Model 1B was a stricter model, without covariances between PBL constructs.

The measurement model of PBL and graduates' competencies constructs were explained in Chapter 4 (Section 4.1 and 4.2 respectively). The following sections present the result of the tested models.

### 6.4.1 The effect of PBL on Personal and organisational competencies

#### 6.4.1.1 Model 1A

Model 1A investigated the effect of PBL on Personal and organizational competencies. The model consisted of seven latent variables (factors). The indicators of the latent variable were presented in Chapter 4 (Table 5.16 for PBL indicators and Table 5.22 for the indicators of Personal and organizational competencies).

As can be seen in Figure 6.1, Model 1A consists of a structural model which employs the measurement model of SCL (Figure 5.2), Small group (Figure 5.4), Problem as stimulus (Figure 5.6), Real-world problems (Figure 5.7), Teacher as facilitator (Figure 5.9), Self-directed learning (Figure 5.11) and Personal and organizational competencies (Figure 5.14). To reduce the size of the path diagram and to make the model easier to understand, the model was simplified by excluding the indicators of each latent variable. The simplified version of Model 1A is presented in Figure 6.2. For the same reasons, further parts of the analysis in this chapter presented only the simplified models.

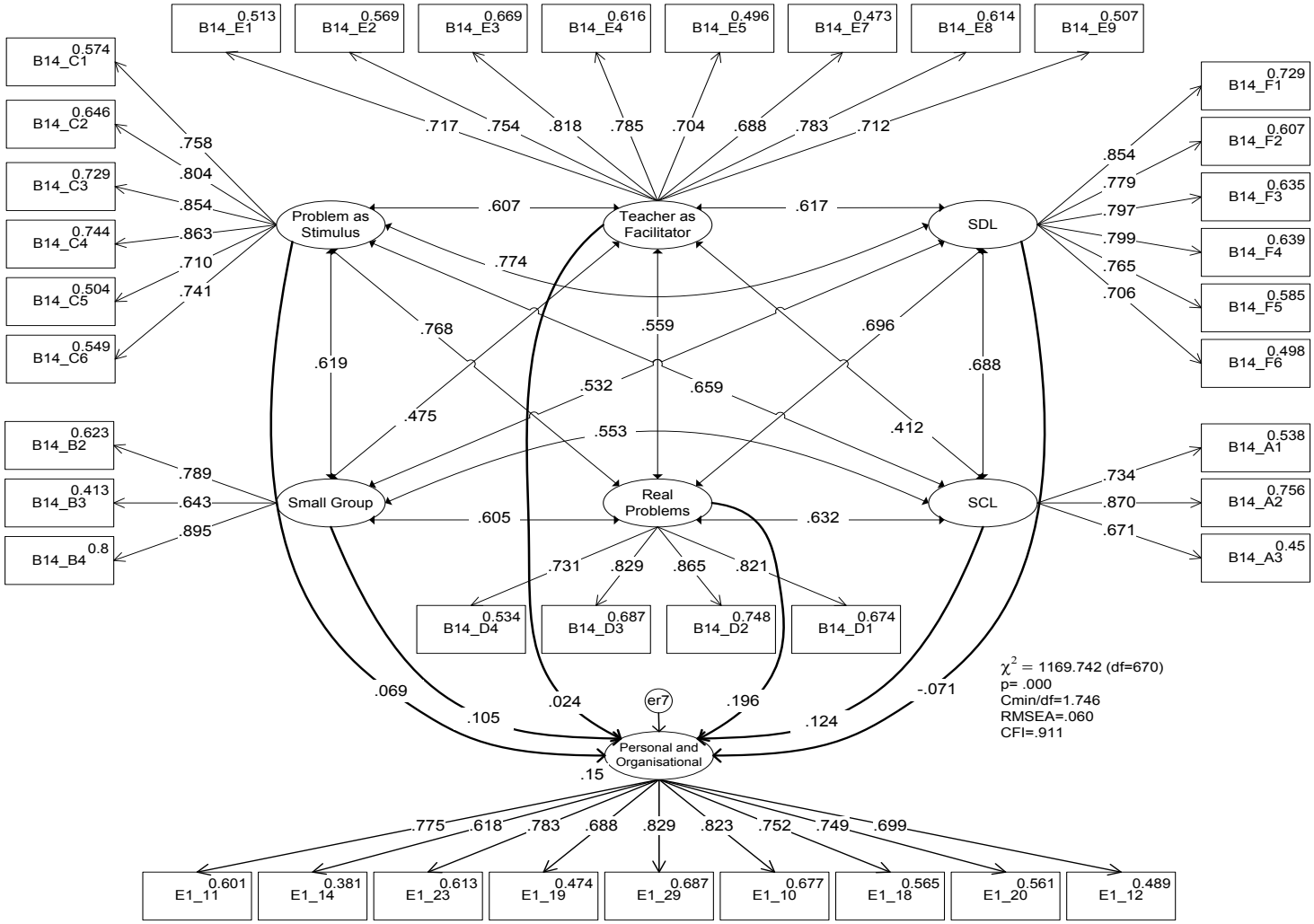
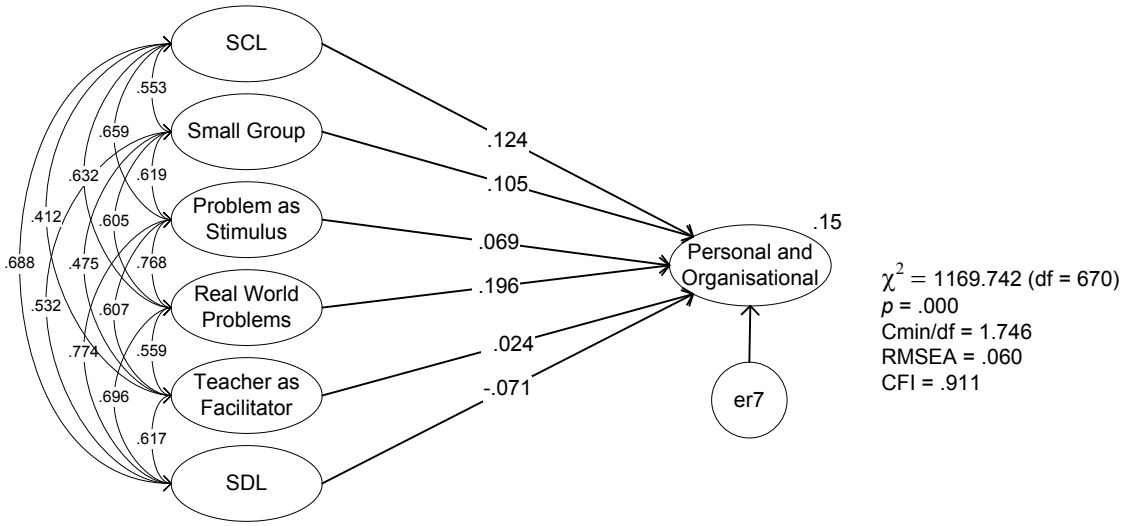



Figure 6.1 Model 1A. The effects of PBL on Personal and organizational competencies.

*Note*. Measurement errors are excluded to reduce the size of the path diagram




*Note*. All indicators and its measurement errors are excluded to reduce the size of the path diagram.

Figure 6.2 Model 1A. The effects of PBL on Personal and organisational competencies (Simplified version)

When Model 1A (Figure 6.2) was fit to the data, the following fit indices resulted:$\chi^2$ (670, $N$ = 210) = 1169.742, $p$ = .00, RMSEA = .060, CFI = .911. The RMSEA was as suggested value of a good model, however the CFI is slightly below the requirement of a good model: RMSEA < .08 and CFI > .92 (Hair, et al., 2010). As can be seen in Figure 6.2, Real-world problems factor has the highest effect on Personal and organisational competencies followed by the Student-centred learning factor. This can be seen from the factor loading (standardized regression weight) of Real-world problems and Student-centred learning (.196 and .124 respectively).

In Figure 6.2, the value above the Personal and organisational factor (.15) is the squared of multiple correlation. This value indicates the amount of the variability in Personal and organisational competencies that is explained by PBL factors. The .15 value means that PBL factors accounted for 15% of the variability in Personal and organisational competencies.

The regression weight has the same trend with the factor loading (Table 6.1). However, none of the PBL factors has significant regression weight ($p$ > .05).

Table 6.1
Regression weight of PBL to Personal and organisational competencies (Model 1A)

| | *β* | SE | CR | *p** |
|---|---|---|---|---|
| Student-centred learning | .091 | .092 | .992 | .160 |
| Small group | .066 | .066 | .998 | .159 |
| Problem as stimulus | .052 | .118 | .443 | .329 |
| Real-world problems | .147 | .102 | 1.446 | .074 |
| Teacher as facilitator | .016 | .069 | .239 | .405 |
| Self-directed learning | -.040 | .084 | -.477 | .316 |

*Note*. * one-tailed. SE: Standard error. CR: Critical ratio.

6.4.1.2 Model 1B

Model 1B is a more constrained model compared to Model 1A (i.e. without covariance between PBL constructs). Model 1B in its simplified form is presented in Figure 6.3.

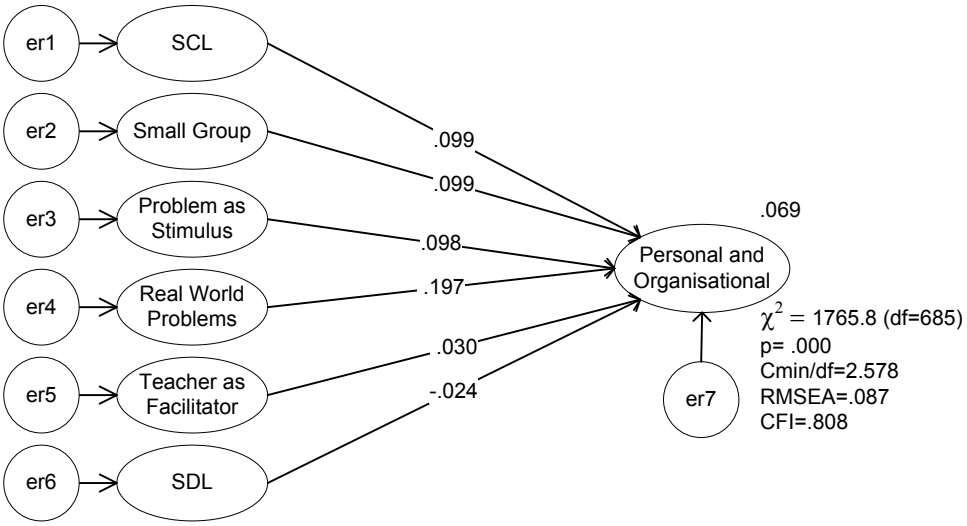



Figure 6.3 Model 1B. The effect of PBL on Personal and organisational competencies

When Model 1B was fit to the data, the following fit indices resulted: $\chi^2$ (685, $N$ = 210) = 1765.8, $p$ = .00, RMSEA = .087, CFI = .808. These values were still below the requirement of a good model, RMSEA < .08 and CFI > .92 (Hair, et al., 2010).

As can be seen in Figure 6.3, the Real-world problems factor has the highest effect on Personal and organisational competencies. This can be seen from the factor loading or standardized regression weight (.197).

The squared multiple correlation of PBL to Personal and organisational factor was .069 (Figure 6.3). This means in model 1B, PBL factors accounted for 6.9% of the variability in Personal and organisational competencies.

Table 6.2 presents the result of the regression weight of Model 1B. From six factors of PBL only Real-world problems has a significant effect on Personal and organisational competencies (β = .140, $p < .01$).

Table 6.2
Regression weight of PBL to Personal and organisational competencies (Model 1B)

| | *β* | SE | CR | *p** |
|---|---|---|---|---|
| Student-centred learning | .071 | .055 | 1.299 | .097 |
| Small group | .055 | .041 | 1.341 | .090 |
| Problem as stimulus | .073 | .055 | 1.330 | .092 |
| Real-world problems | .140 | .054 | 2.584 | .005 |
| Teacher as facilitator | .020 | .048 | .408 | .341 |
| Self-directed learning | -.013 | .041 | -.321 | .374 |

*Note*. * one-tailed. SE: Standard error. CR: Critical ratio.

### 6.4.2 The effect of PBL on Field-related competencies

#### 6.4.2.1 Model 2A

Model 2A investigated the effect of PBL on Field-related competencies. As can be seen in Figure 6.4, Model 2A is a simplified version of the model (the indicators of the latent variables were invisible). The indicators of the latent variables were presented in Chapter 4. The measurement model of the latent variables can be seen in Figure 5.2 (SCL), Figure 5.4 (Small group), Figure 5.6 (Problem as stimulus), Figure 5.7 (Real-world problems), Figure 5.9 (Teacher as facilitator), Figure 5.11 (Self-directed learning), and Figure 5.18 (Field-related competencies).

When Model 2A (Figure 6.4) was fit to the data, the following fit indices resulted: $\chi^2$ (564, $N$ = 210) = 989.013, $p$ = .00, RMSEA = .060, CFI = .916. The RMSEA value is as suggested of a good model, however the CFI is slightly below the requirement of a good model: RMSEA < .08 and CFI > .92 (Hair, et al., 2010).

As can be seen in Figure 6.4, Self-directed learning has the highest effect on Field-related competencies followed by Teacher as facilitator. This can be seen from the factor loading (standardized regression weight) of Self-directed learning and Teacher as facilitator (.150 and .098 respectively).

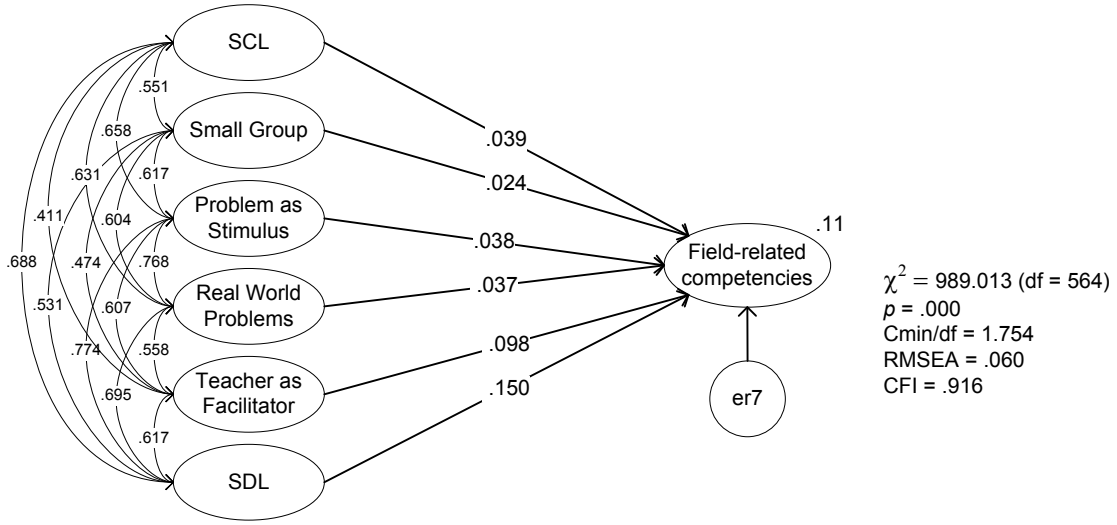



Figure 6.4 Model 2A. The effect of PBL on Field-related competencies

The squared multiple correlation of PBL to Field-related competencies was .11 (Figure 6.4). This means in model 2A, PBL factors accounted for 11% of the variability in Field-related competencies.

Table 6.3 depicts the regression weight of PBL to Field-related competencies in model 2A. The regression weight has the same trend with the factor loadings. However, none of the PBL factors has significant regression weight ($p > .05$).

Table 6.3
Regression weight of PBL to Field-related competencies (Model 2A)

| | $\beta$ | SE | CR | $p$* |
|---|---|---|---|---|
| Student-centred learning | .027 | .088 | .306 | .379 |
| Small group | .014 | .063 | .222 | .412 |
| Problem as stimulus | .027 | .114 | .235 | .407 |
| Real-world problems | .026 | .097 | .264 | .396 |
| Teacher as facilitator | .062 | .067 | .919 | .179 |
| Self-directed learning | .079 | .082 | .966 | .167 |

*Note*. * one-tailed. SE: Standard error. CR: Critical ratio.

#### 6.4.2.2 Model 2B

Model 2B is a more constrained model investigating the effect of PBL on Field-related competencies. The covariance paths between the PBL factors were eliminated. The simplified version of the model can be seen in Figure 6.5.

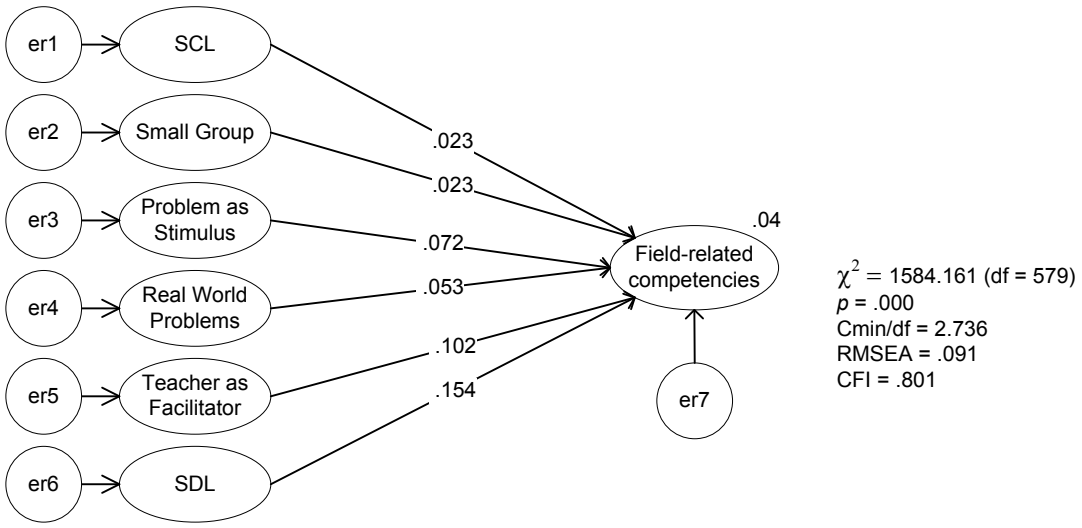



Figure 6.5 Model 2B. The effect of PBL on Field-related competencies

When Model 2B was fit to the data, the following fit indices resulted: $\chi^2$ (579, N = 210) = 1584.161, $p$ = .00, RMSEA = .091, CFI = .801. These values are still below the requirement of a good model, RMSEA < .08 and CFI > .92 (Hair, et al., 2010).

As can be seen in Figure 6.5, Self-directed learning has the highest effect on Field-related competencies followed by Teacher as facilitator. This can be seen from the factor loading of Self-directed learning and Teacher as facilitator (.154 and .102 respectively).

The squared multiple correlation of PBL to Field-related competencies is .04 (Figure 6.5). This means in model 2B, PBL factors accounted for 4% of the variability in Field-related competencies.

Table 6.4 presents the regression weight of Model 2B. From six factors of PBL only Self-directed learning has a significant effect on Field-related competencies ($\beta$ = .080, $p$ < .05).

Table 6.4
Regression weight of PBL to Field-related competencies (Model 2B)

| | $\beta$ | SE | CR | $p$* |
|---|---|---|---|---|
| Student-centred learning | .015 | .053 | .294 | .385 |
| Small group | .012 | .039 | .309 | .379 |
| Problem as stimulus | .050 | .053 | .949 | .172 |
| Real-world problems | .035 | .051 | .692 | .245 |
| Teacher as facilitator | .062 | .047 | 1.325 | .096 |
| Self-directed learning | .080 | .040 | 1.975 | .024 |

*Note*. * one-tailed. SE: Standard error. CR: Critical ratio.

### 6.4.3 The effect of PBL on Leadership

#### 6.4.3.1 Model 3A

Model 3A investigated the effect of PBL on Leadership. Figure 6.6 shows the simplified version of the model (the indicators of the latent variables are invisible). The indicators of the latent variables were presented in Chapter 4. The measurement model of the latent variables can be seen in Figure 5.2 (SCL), Figure 5.4 (Small group), Figure 5.6 (Problem as stimulus), Figure 5.7 (Real-world problems), Figure 5.9 (Teacher as facilitator), Figure 5.11 (Self-directed learning), and Figure 5.16 (Leadership).

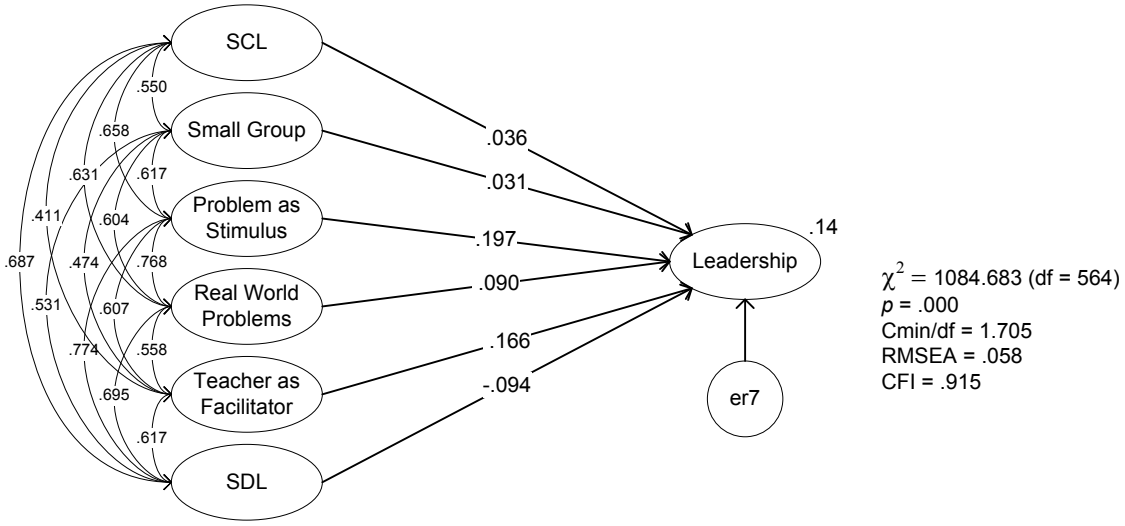



Figure 6.6 Model 3A. The effect of PBL on Leadership

When Model 3A (Figure 6.6) was fit to the data, the following fit indices result: $\chi^2$ (564, $N$ = 210) = 1084.683, $p$ = .00, RMSEA = .058, CFI = .915. The RMSEA is as suggested of a good model, however the CFI is below the requirement of a good model: RMSEA < .08 and CFI > .92 (Hair, et al., 2010). As can be seen in Figure 6.6, Problem as stimulus has the highest effect on Leadership followed by Teacher as facilitator. This can be seen from the factor loading (standardized regression weight) of Problem as stimulus and Teacher as facilitator (.197 and .166 respectively).

The squared multiple correlation of PBL to Leadership is .14 (Figure 6.6). This means in model 3A, PBL factors accounted for 14% of the variability in Leadership.

Table 6.5 depicts the regression weight of PBL to Leadership in Model 3A. The regression weight has the same trend with the factor loadings. However, none of the PBL factors have significant regression weight ($p$ > .05).

Table 6.5
Regression weight of PBL to Leadership (Model 3A)

| | $\beta$ | SE | CR | $p$* |
|---|---|---|---|---|
| Student-centred learning | .035 | .120 | .290 | .386 |
| Small group | .026 | .086 | .298 | .383 |
| Problem as stimulus | .196 | .156 | 1.258 | .104 |
| Real-world problems | .089 | .133 | .667 | .253 |
| Teacher as facilitator | .147 | .092 | 1.599 | .055 |
| Self-directed learning | -.070 | .111 | -.628 | .265 |

*Note*. * one-tailed. SE: Standard error. CR: Critical ratio.

6.4.3.2 Model 3B

Model 3B is a more constrained model in investigating the effect of PBL on Leadership; the covariance paths between the PBL factors are omitted. The simplified version of the model can be seen in Figure 6.7.

When Model 3B was fit to the data, the following fit indices resulted: $\chi 2$ (651, $N$ = 210) = 1679.833, $p$ = .00, RMSEA = .087, CFI = .806. These values are still below the requirement of a fit model, RMSEA < .08 and CFI > .92 (Hair, et al., 2010).

Figure 6.7 shows that Problem as stimulus has the highest effect on Leadership followed by Teacher as facilitator. This can be seen from the factor loading of Problem as stimulus and Teacher as facilitator (.185 and .165 respectively).

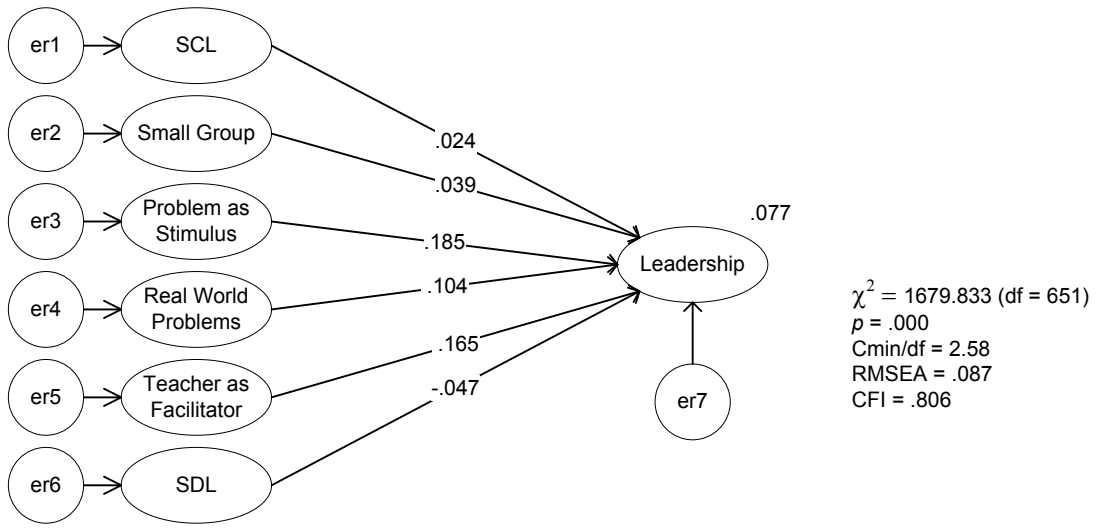



Figure 6.7 Model 3B. The effect of PBL on Leadership

The squared multiple correlation of PBL to Leadership is .077 (Figure 6.7). This means in model 3B, PBL factors accounted for 7.7% of the variability in Leadership.

Table 6.6 presents the regression weight in Model 3B. From six factors of PBL only two have significant effect on PBL: Problem as stimulus ($\beta$ = .182, $p$ < .01) and Teacher as facilitator ($\beta$ = .142, $p$ < .05).

Table 6.6
Regression weight of PBL to Leadership (Model 3B)

| | $\beta$ | SE | CR | $p$* |
|---|---|---|---|---|
| Student-centred learning | .023 | .072 | .325 | .373 |
| Small group | .029 | .053 | .538 | .296 |
| Problem as stimulus | .182 | .073 | 2.487 | .006 |
| Real-world problems | .098 | .070 | 1.405 | .080 |
| Teacher as facilitator | .142 | .065 | 2.200 | .014 |
| Self-directed learning | -.034 | .054 | -.635 | .263 |

*Note*. * one-tailed. SE: Standard error. CR: Critical ratio.

### 6.4.4 The effect of PBL on Interpersonal competencies

#### 6.4.4.1 Model 4A

Model 4A investigated the effect of PBL on Interpersonal competencies. Figure 6.8 shows the simplified version of the model (the indicators of the latent variables are excluded). The indicators of the latent variables were presented in Chapter 4. The measurement model of the latent variables can be seen in Figure 5.2 (SCL), Figure 5.4 (Small group), Figure 5.6 (Problem as stimulus), Figure 5.7 (Real-world problems), Figure 5.9 (Teacher as facilitator), Figure 5.11 (Self-directed learning), and Figure 5.20 (Interpersonal competencies). When Model 4A (Figure 6.8) was fit to the data, the following fit indices resulted: $\chi^2$ (567, $N$ = 210) = 985.503, $p$ = .00, RMSEA = .059, CFI = .914. The RMSEA is as suggested of a good model, however the CFI is below the requirement of a fit model: RMSEA < .08 and CFI > .92 (Hair, et al., 2010).

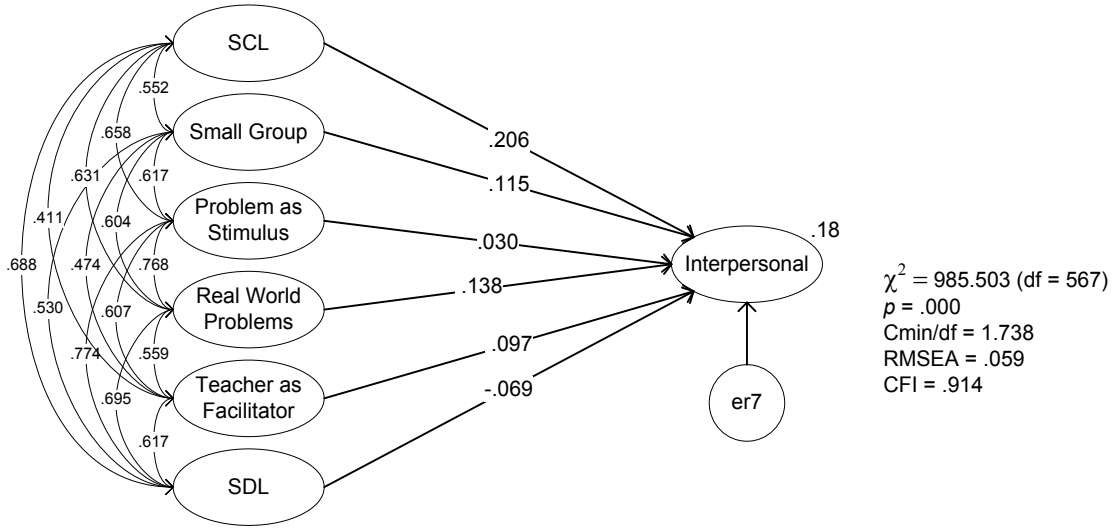



Figure 6.8 Model 4A. The effect of PBL on Interpersonal competencies

As can be seen in Figure 6.8, Student-centred learning (SCL) has the highest effect on Interpersonal competencies followed by Real-world problems. This can be seen from the factor loading (standardized regression weight) of Student-centred learning and Real-world problems (.206 and .138 respectively).

The squared multiple correlation of PBL to Interpersonal competencies is .18 (Figure 6.8). This means in model 4A, PBL factors accounted for 18% of the variability in Interpersonal competencies.

Table 6.7 depicts the regression weight of PBL to Interpersonal competencies in Model 4A. The regression weight has the same trend with the factor loadings. However, none of the PBL factors have significant regression weight ($p > .05$).

Table 6.7
Regression weight of PBL to Interpersonal competencies (Model 4A)

| | $\beta$ | SE | CR | $p$* |
|---|---|---|---|---|
| Student-centred learning | .166 | .105 | 1.583 | .057 |
| Small group | .079 | .074 | 1.060 | .145 |
| Problem as stimulus | .025 | .134 | .186 | .426 |
| Real-world problems | .114 | .115 | .990 | .161 |
| Teacher as facilitator | .073 | .079 | .920 | .179 |
| Self-directed learning | -.043 | .096 | -.449 | .327 |

*Note*. * one-tailed. SE: Standard error. CR: Critical ratio.

6.4.4.2 Model 4B

Model 4B is a more constrained model in investigating the effect of PBL on Interpersonal competencies. The covariance paths between the PBL factors are eliminated. The simplified version of the model can be seen in Figure 6.9.

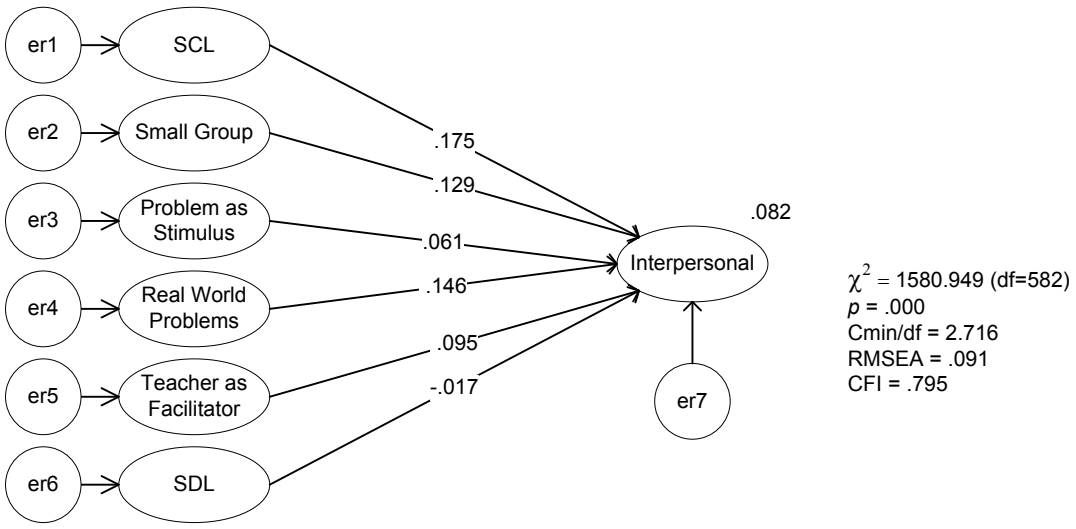



Figure 6.9 Model 4B. The effect of PBL on Interpersonal competencies

When Model 4B was fit to the data, the following fit indices resulted: $\chi^2$ (582, $N$ = 210) = 1580.949, $p$ = .00, RMSEA = .091, CFI = .795. These values are still below the requirement of a good model, RMSEA < .08 and CFI > .92 (Hair, et al., 2010).

Figure 6.9 shows that Student-centred learning (SCL) has the highest effect on Interpersonal competencies and the second highest effect is found in Real-world problems. This can be seen from the factor loading (standardized regression weight) of SCL and Real-world problems (.175 and .146 respectively).

The squared multiple correlation of PBL to Interpersonal competencies is .082 (Figure 6.9). This means in model 4B, PBL factors accounted for 8.2% of the variability in Interpersonal competencies.

Table 6.8 presents the regression weight of Model 4B. From six PBL factors, three have significant effect on Interpersonal competencies: Student-centred learning ($\beta$ = .137, $p$ < .05), Small group ($\beta$ = .078, $p$ < .05), Real-world problem ($\beta$ = .114, $p$ < .05).

Table 6.8
Regression weight of PBL to Interpersonal competencies (Model 4B)

| | $\beta$ | SE | CR | $p$* |
|---|---|---|---|---|
| Student-centred learning | .137 | .063 | 2.170 | .015 |
| Small group | .078 | .047 | 1.675 | .047 |
| Problem as stimulus | .049 | .062 | .797 | .213 |
| Real-world problems | .114 | .061 | 1.865 | .031 |
| Teacher as facilitator | .067 | .055 | 1.221 | .111 |
| Self-directed learning | -.010 | .047 | -.221 | .413 |

*Note*. * one-tailed. SE: Standard error. CR: Critical ratio.

## 6.5 Discussion

This chapter investigated the effects of PBL on graduates' competencies by employing structural models. The aim of the analysis was to identify the effect of each PBL component on graduates' competencies. The analysis was based on a quantitative data collected in a graduate survey. Graduates of the Faculty of Medicine, Gadjah Mada University were surveyed eight months to three years after graduation. Four units of analysis were conducted. Each unit consisted of two models investigating the effect of PBL on graduates' competencies.

Two models (Model A and Model B) were tested to investigate the effect of each PBL component on graduates' competencies. The results of Model B showed that each component of PBL has certain effects on graduates' competencies. The summary of the results are presented in Table 6.9. These results fulfilled the objectives of the study stated in the introduction chapter.

As can be seen in Table 6.9, the highest impact of PBL on competencies is found in the effect of Problem as stimulus on Leadership ($\beta$ = .182, $p$ < .01) followed by the effect of Teacher as facilitator on Leadership ($\beta$ = .142, $p$ < .05), and the effects of Real-world problems on Personal and organisational competencies ($\beta$ = .140, $p$ < .01). The lowest effect was found in the effects Small group on Interpersonal competencies ($\beta$ = .078, $p$ < .05).

Table 6.9
Summary of PBL effects on graduates' competencies (Model B)

| | Personal and organisational | | Field-related | | Leadership | | Interpersonal | |
|---|---|---|---|---|---|---|---|---|
| | *β* | *p* | *β* | *p* | *β* | *p* | *β* | *p* |
| Student-centred learning | .071 | .097 | .015 | .385 | .023 | .373 | .137* | .015 |
| Small group | .055 | .090 | .012 | .379 | .029 | .296 | .078* | .047 |
| Problem as stimulus | .073 | .092 | .050 | .172 | .182** | .006 | .049 | .213 |
| Real-world problems | .140** | .005 | .035 | .245 | .098 | .080 | .114* | .031 |
| Teacher as facilitator | .020 | .341 | .062 | .096 | .142* | .014 | .067 | .111 |
| Self-directed learning | -.013 | .374 | .080* | .024 | -.034 | .263 | -.010 | .413 |

*Note.* All *p* are one-tailed. *$p < .05$. **$p < .01$.

The following sections discuss the effects of PBL on each group of graduates' competencies. The discussion is mainly focussed on the causal relation of the factors' indicators. The last section of the discussion addresses the moderate values of squared multiple correlation in the models.

### 6.5.1 The effects of PBL on Personal and organisational competencies

Personal and organisational competencies were significantly affected by Real-world problems used in the PBL tutorial process. In this study, Personal and organisational competencies refer to competencies such as: reflective thinking, taking initiative, problem solving ability, taking decisions and responsibilities, ability to work under pressure, and analytical competencies. Figure 6.10 illustrates the complete indicators of Real-world problems and Personal and organisational competencies.

How do Real-world problems affect Personal and organisational competencies? In the PBL process students are presented with problems which will be the trigger of the learning process. The problems are intended to enhance their motivation, reactivate their prior knowledge, and promote self-directed learning (Marchais, 1999).

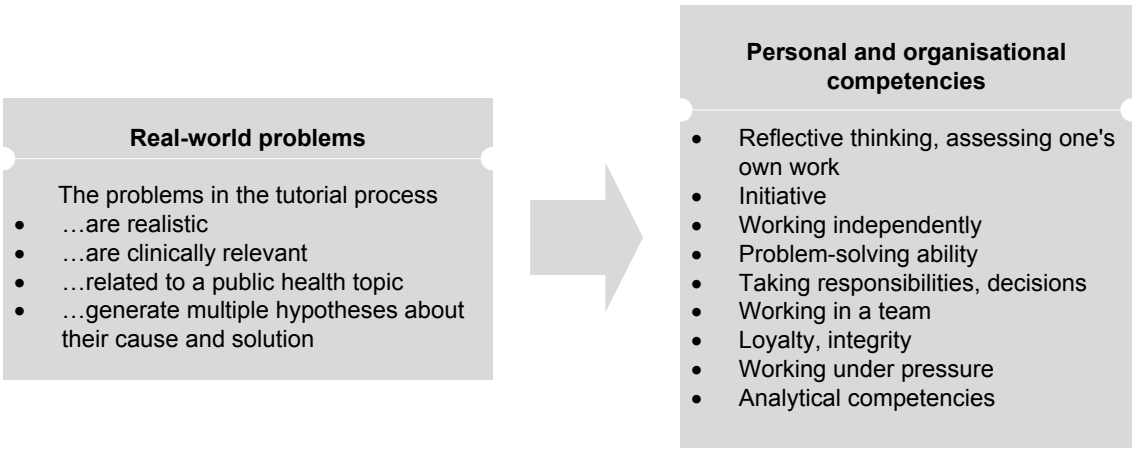



Figure 6.10 Indicators of Real-world problems and Personal and organisational competencies

Barrows (1996) stated that the problems in the PBL process are a vehicle for developing clinical problem-solving skills. Therefore, the problems in the PBL tutorial process have to present the patient problem in the same way that it occurs in the real-world (Barrows, 1996). The real-world problems were developed based on the challenges that students will face as a physician. When a physician first meets the patient, there is usually insufficient information available to decide on a diagnosis and a plan care (Barrows, 2000). The patient usually comes only with complaints about their health. The physician needs to obtain more information (e.g. medical record, laboratory results, and medical journals) in order to decide on further action. Despite this, after a complete investigation of patient's problems, the physician can never be certain that the decided diagnosis is correct and that the action plan chosen is the best decision (Barrows, 2000).

Exposed to real-world problems in PBL, students will enhance their Personal and organisational competencies. In PBL students are facing the real-world problems in the form of the scenarios or problems they have in the tutorial process. They are exposed to conditions that stimulate their *analytical thinking*. By facing these challenges, students will learn that patients are not equipped with complete information about their conditions and therefore the physician has to search for additional information. Students are trained to take the *initiative* to search for additional information from all possible sources. They have to *work independently* or *in a team* to achieve their goal. Additionally, the *analytical thinking* is trained by selection of the information gathered in order to select the one which is appropriate to the patient problems. Consequently, students also practiced *reflective thinking*, assessing their own work.

Students learn to adapt to uncertainty. Even after thorough information gathering, they can never be certain about the diagnosis and the follow up action. This allows students to learn *working under pressure* and *take responsibility* for their decisions.

This finding supported prior findings that PBL has a positive impact on graduates' Personal and organisational competencies (Patria, 2011). Another study pointed out that PBL has an effect on task-supporting competencies (Schmidt, et al., 2006). The indicators of task-supporting competencies used Schmidt and colleagues' (2006) study–such as: ability to work independently, planning, being efficient, and being able to work under pressure–were similar with the indicators of Personal and organisational competencies in the present study.

### 6.5.2 The effects of PBL on Field-related competencies

Field-related competencies were affected significantly by the Self-directed learning (SDL) component in PBL. The SDL component in PBL affected graduates' Field-related competencies including: field-specific theoretical knowledge, field-specific knowledge of methods, cross disciplinary theoretical knowledge, broad general knowledge, critical thinking and self-directed learning skills. Figure 6.11 illustrates the complete indicators of SDL and Field-related competencies.

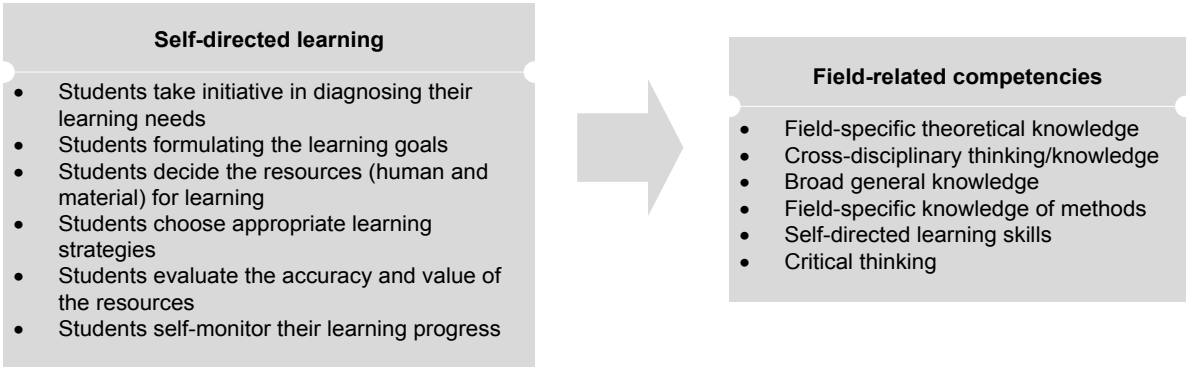



Figure 6.11 Indicators of Self-directed learning and Field-related competencies

In PBL, SDL activities manifest in several forms. SDL activities mostly happen in the second step of the tutorial, the individual study. However, in the first meeting of the tutorial process, students are required to discuss and diagnose their learning needs. At the end of the first meeting students have to formulate the learning goals by themselves before starting the individual study. These activities are also regarded as a part of SDL.

In the individual study the SDL activities were started with the decision about the source of information students want to use. Then they have to collect information needed to achieve the learning goals. Students have to decide the best sources of information that they should learn from. It could be from resources in a library (e.g. journal articles, books, and case record), internet, or experts. Students have to carefully select the information and evaluate the accuracy and the value of the resources.

Students also learn to assess and monitor their own learning progress. They have to decide whether the information is sufficient or not for achieving the learning goals.

These SDL activities in PBL develop the SDL skills needed by physicians. SDL skills are needed by physicians to keep up with the developments in medicine; in theoretical knowledge as well as the knowledge of method. Physicians have to continue learning to meet the changing problems and needs of the patients, the health care system, and to keep up-to-date on medical knowledge and practice (Barrows, 2000).

The SDL activities also strengthen *cross-disciplinary thinking* and *broad general knowledge*. Besides the knowledge and skills related to medicine, students have to add information from other fields in order to understand the problems they face. Students also develop *critical thinking skills*; they have to apply the available information to solve the problems presented in the tutorial process.

This result supported prior finding on the effect of PBL on graduates' field-related competencies. Patria (2011) stated that compared to graduates from a conventional curriculum, PBL graduates rated themselves higher in field-related competencies (i.e. field-specific theoretical knowledge, field-specific knowledge of methods, and analytical competencies). Two other studies also pointed out that PBL graduates rated themselves better in professional skills (e.g. physical examination) (Schmidt & van der Molen, 2001; Schmidt, et al., 2006; Tamblyn, et al., 2005).

Another study by Shin et al. (1993) revealed that graduates from PBL and self-directed undergraduate curriculums are more up to date in their specific field compared to graduates of conventional curriculums. Woods' (1996) study, even though limited to engineering graduates, showed that employers who hired PBL graduates gave highly positive comments regarding

their self-directedness and independence in solving work-related problems and improving professional development.

It is important to note that in the present study, Field-related competencies were affected only by SDL factor in PBL. Faculty members and educators in conventional curriculums are usually concerned about self-directed learning because minimally guided instruction is believed to be less effective and less efficient than instructional approaches (Kirschner, et al., 2006). This study empirically showed that SDL has a significant effect on the development of Field-related competencies. In PBL, SDL is not regarded as minimally guided instruction as argued by Kirschner et al. (2006). Rather, SDL in PBL provides extensive scaffolding and guidance to facilitate student learning (Hmelo-Silver, et al., 2006).

### 6.5.3 The effects of PBL on Leadership

Leadership was affected significantly by two PBL components: Problem as stimulus and Teacher as facilitator. The Leadership factor in this study consisted of indicators such as: leadership; negotiation; creativity; documenting ideas and information; and planning, co-ordinating and organising. Figure 6.12 lists the indicators of the factors.

The discussion of the effects of PBL on Leadership is divided into two sections. The first discuses the effect of Teacher as facilitator, followed by the effect of Problem as stimulus.

#### 6.5.3.1 The effects of Teacher as facilitator on Leadership

The role of teacher is crucial in PBL because it differentiates PBL from other learning and teaching methods, especially from the conventional approach (lecture-based learning). In PBL the role of teacher is not as source of information. In PBL, the teacher (referred to as tutor) has a role as facilitator. The tutor does not give students a lecture or factual information, does not tell students whether they are right or wrong, and does not tell them what they ought to study or read (Barrows, 2000). The tutor role is to guide the students, ask students the kinds of questions that they should be asking themselves to better understand and manage the problem (Barrows, 2000). The indicators of Teacher as facilitator illustrated in Figure 6.12 describe the role of teacher as facilitator in PBL.

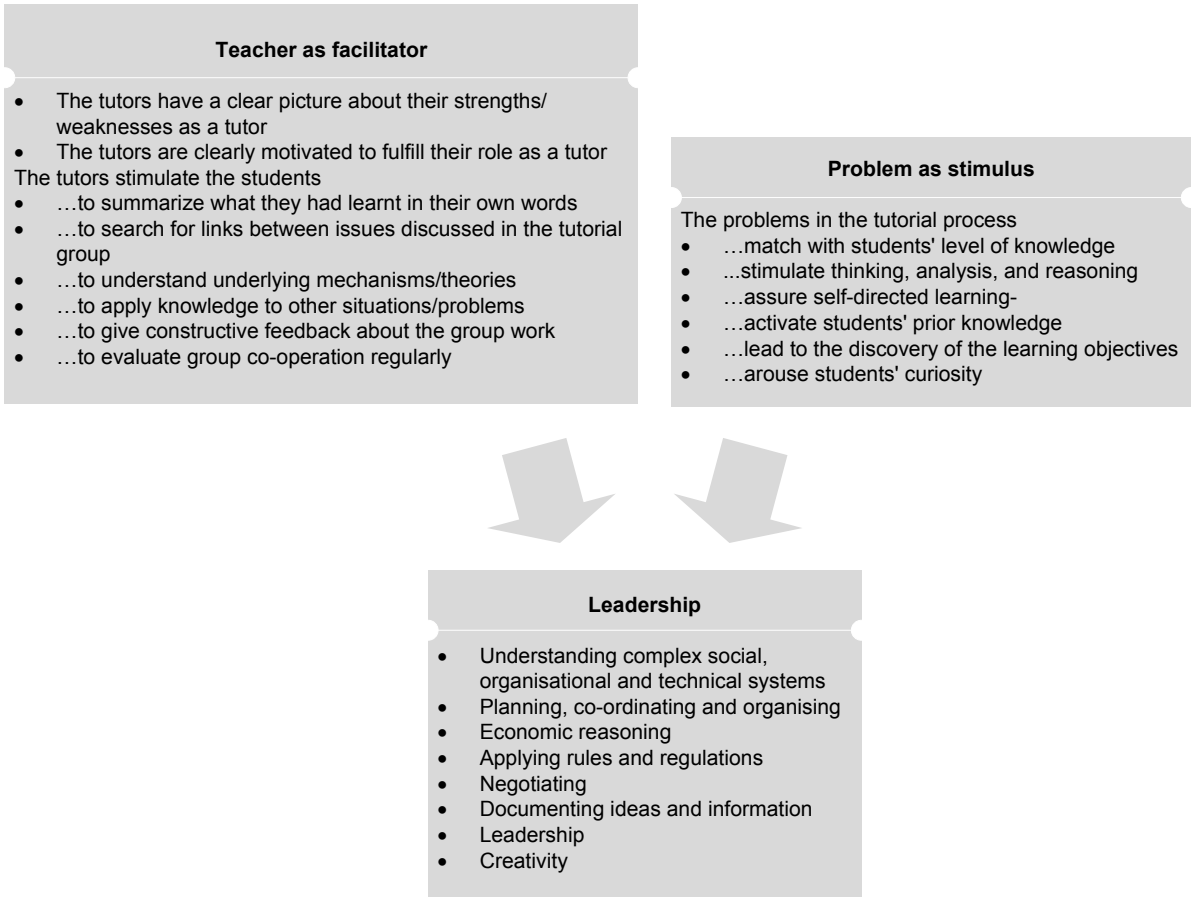



Figure 6.12 Indicators of Teacher as facilitator, Problem as stimulus and Leadership

In this study the Teacher as facilitator factor had a significant effect on Leadership. The role of teacher as facilitator enables students to have more responsibility in their learning. This enables students to have a bigger share of the learning process compared to conventional curriculum. A bigger share of the learning process means that students learn to be responsible for their own learning, instead of relying on the teachers. This naturally will develop students' leadership competencies.

The role of teacher as facilitator intensifies the discussion process in PBL. The elaboration and discussion of the problems encourage students to practice leadership competencies such as *negotiation*, *creativity*, *documenting ideas and information*. The process is also a good opportunity for the students to *understand complex social*, *organisational*, and *technical systems*.

In this study *economic reasoning* was included as one indicator of Leadership. Barrows and Tamblyn (1980) stated that as facilitator, the tutor allows students to discover their own mistakes because this is how the learning process happens. In the process the tutor also

encourages students to apply *reasoning skills* in the problem they are facing (Barrows & Tamblyn, 1980).

In a PBL tutorial one student should take the role as a leader of the discussion group. This is the most obvious difference between PBL and conventional curriculum in term of leadership development. The leader of the group should lead the process of discussion to have a tentative explanation about the problems and eventually reach the agreement of the learning goals they have to achieve. The group then have to *plan, coordinate* and *organize* the individual study based on the learning goals. Students are divided to tackle specific parts of the learning goals. In the last group-meeting the students should share what they have learnt with each other to construct a new understanding of the problems.

This result is in accordance with prior studies on the effect of PBL to Leadership competencies (Patria, 2011; Prince, et al., 2005).

#### 6.5.3.2 The effects of Problems as stimulus on Leadership

In the first meeting of the PBL tutorial, students are given problems in the form of a scenario. The problems are intended to enhance their motivation, reactivate their prior knowledge, and promote self-directed learning (Marchais, 1999).

Students are faced with problems without prior preparation. Teachers from conventional curriculums often object to this idea with the argument that students will perform better if they are prepared beforehand to face the problems (e.g. Kirschner, et al., 2006). However, Barrows (2000) stated that taking the problems without prior preparation allows the students to discover what they already know or understand about the problem. This will motivate students to learn more. Additionally, the activation of prior knowledge during the encounter with the problem provides an anchor for remembering new information thus ensuring better retention and recall (Barrows, 2000; Norman & Schmidt, 1992).

The problems represent the challenges students will face as physicians and provide relevance and motivation for learning (Barrows, 1996). Students realize that later (as physicians) they will face the same problems. Students will have the insight that their current knowledge is not sufficient to solve the problems they face. This condition will be a motivational boost for the students to be responsible for the learning process.

In the process of PBL, Problem as stimulus has a direct relation with the development of Leadership indicators as illustrated in Figure 6.12. Learning based on problems opens the opportunity for students to encounter complex and incomplete conditions. Students learn to *plan*, *coordinate* and *organise* their own learning action. In the process of discussing the problems students learn *reasoning skills*, *negotiation*, and *documenting ideas and information*. In the same time their *creativity* is challenged to be able to explain the problems they faced with the information they have from individual study.

### 6.5.4 The effects of PBL on Interpersonal competencies

Three PBL factors had significant effects on graduates' Interpersonal competencies: Student-centred learning (SCL), Small group, and Real-world problems. Figure 6.13 illustrates the complete indicators of each factor.

The discussion of the effects of PBL on Interpersonal competencies is divided into three sections: the effects of SCL, the effects of Small group, and the effects of Real-world problems.

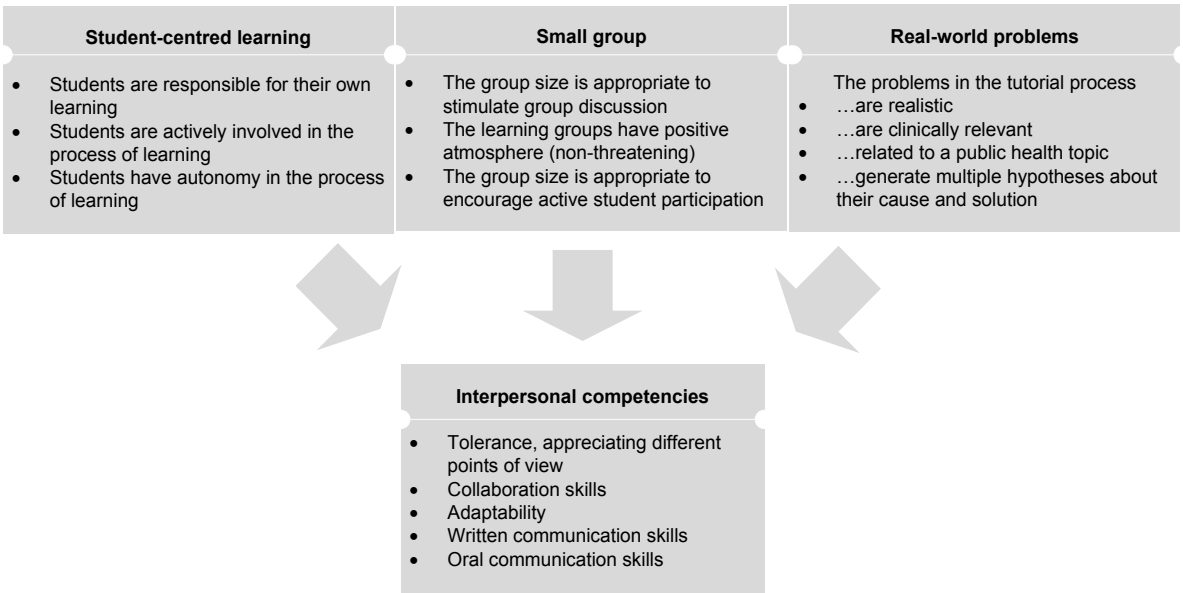



Figure 6.13 The indicators of Student-centred learning, Small group, Real-world problems, and Interpersonal competencies

#### 6.5.4.1 The effects of Student-centred learning on Interpersonal competencies

This study showed that the Student-centred learning (SCL) component in PBL has significant effects on graduates' Interpersonal competencies. SCL led to better Interpersonal competencies

such as: tolerance, collaboration skills, adaptability, as well as written and oral communication skills.

SCL comprises a condition of teaching and learning where students have more responsibility of their own learning. Students should be actively involved in the process of learning. This kind of autonomy in the process of learning does not exist in the conventional teaching and learning method (i.e. teacher-centred learning).

In PBL, students have the responsibility of their own learning. Guided by the tutor, students have to discuss the problems in the module and then decided their own learning goals. Afterwards students have to conduct individual study. They have to decide their own sources of learning and use them to achieve the learning goals. At the end of the module the students have to share their findings within their group. In the discussion they have to integrate the knowledge they acquires from the individual study to develop a comprehensive explanation for the problem. With the obligation to share what they have learned in the individual study, students also have the responsibility of their peer's process of learning. When one student fails to achieve the learning goals they also jeopardize the learning process of the group. This will increase their sense of responsibility with their learning activity. At the same time, students also learn to *collaborate* with their peers. They have to work together and have *tolerance* with others students opinions.

In PBL students have more opportunities for presentations and active discussion; this activity mostly happens in the first and last meetings when they have to elaborate their findings. These activities trained their *oral* and *written communication skills*.

This finding is in accordance with prior research on the impact of PBL on graduates' interpersonal competencies. For example Nandi et al. (2000) found that students who experienced a PBL method showed better interpersonal skills, psychosocial knowledge, and better attitudes towards patients. Other research in this area are also showed similar findings (e.g. Mennin, et al., 1996; Patria, 2011; Prince, et al., 2005; Schmidt, et al., 2006).

#### 6.5.4.2 The effects of Small groups on Interpersonal competencies

In PBL the tutorial process is conducted in a small group, usually consisting of five to nine students (Barrows, 1996). The Small group component in PBL strengthens the process of

student-centred learning, and therefore it improves graduates' interpersonal competencies. The small size of the group stimulates a more intense group discussion. All students will have the opportunity to take part in the discussion. The small size of the group makes it impossible for the student to be passive. Students learn during the PBL process that they have the same share of the discussion. The tutorial group is also non-threatening to the students. Students learn that different opinions are welcomed in the discussion. They learn to appreciate different opinions.

The small size of the group also makes it easier for the students to collaborate. In a small group it is impossible to have free loader (passive student) because each student has a certain role in the tutorial process. Small group discussion in PBL promotes the elaboration of knowledge at the time of learning (Norman & Schmidt, 1992; Van Berkel & Dolmans, 2006). Elaboration manifests in several activities, e.g. discussion, raising opinion, challenging their peer's opinion, note-taking, answering questions, and using knowledge to understand a problem. The process of elaboration will not only enhance the knowledge retrieval process (Norman & Schmidt, 1992), but also promote the attainment of Interpersonal competencies.

#### 6.5.4.3 The effects of Real-world problems on Interpersonal competencies

Section 6.5.1 already discussed the effect of Real-world problems on graduates' Personal and organisational competencies. The discussion of the effect of Real-world problems on Interpersonal competencies in this section is also related to the discussion in section 6.5.1.

Together with a SCL environment, the use of Real-world problems enhances students' Interpersonal competencies. Students encounter problems which represents the problems brought by patients in the real-world (Barrows, 1996). Students encounter problems with incomplete information, thus they have to seek more information in order to decide the next step to deal with the patient. Barrows (2000) stated that despite a complete investigation of patient's problem, physician can never be certain that the diagnosis decided upon is correct and that the action plan chosen is the best decision. In the process of completing information, students learn *collaboration skills*, *written* and *oral communication skills*. Students will also realize that physicians should have better communication skills to obtain as much information as he/she can from the patient. With the understanding that their diagnosis and action plan is not always the best, students will learn *to be tolerant* and *appreciate different points of view*. Students

learn that the information about the patient's problem is always incomplete and that they have to adapt to this condition by searching for additional information.

### 6.5.5 Concern on Goodness-of-fit

One might argue that the Goodness-of-fit (GOF) statistics should be the main concern in any structural model. However, as mentioned in the beginning of this chapter (Section 6.3), the substance or the interpretation of the model should be first thing to consider in structural modelling.

Even though this study's main goal is the interpretation of the model, the GOF of the models were not far from the requirement of a fit model. The CFI values of Model A were still below the cut-off value used in this study (.92), which was based on Hair and colleagues' (2010) recommendation. However, the CFI values of Model 1A (.911), Model 2A (.916), Model 3A (.915), Model 4A (.914) already met the requirement of a good model based on more traditional cut-off values: CFI values greater than .90 (e.g. Hu & Bentler, 1999; Marsh, 1994).

In this study, with a minor respecification, a fit model would be easily achieved for Model A. Nevertheless it was not conducted because the main goal is to investigate the effects of PBL on competencies and not to develop a fit model. Furthermore the respecification of the model would infringe on the underlying theory used in the measurement development.

For example, in Model 2A (Figure 6.4) a simple respecification based on the modification indices would improve the fitness of the model. A fit model could be achieved by: (1) allowing variable B14_C3 "The problems in the tutorial process assure self-directed learning" to cross-load to the Self-directed learning factor; and (2) adding covariance path between the error measurement of B14_C6 "The problems in the tutorial process arouse students' curiosity" and B14_B2 "The group size is appropriate to stimulate group discussion".

After this respecification, Model 2A had fit model indices: $\chi^2$ (562, N = 210) = 962.710, $p$ = .00, RMSEA = .058, CFI = .921. However, this respecification is substantially difficult to explain. The first respecification might be explained by the similarity of the item wording of B14_C3 "The problems in the tutorial process assure self-directed learning" with the Self-directed learning factor. However the path from B14_C3 to SDL is a cross-loading relation, which violated the requirement of discriminant validity. As for the second respecification, there is no underlying

theory supporting the intercorrelation between B14_C6 "The problems in the tutorial process arouse students' curiosity" and B14_B2 "The group size is appropriate to stimulate group discussion". Based on these reasons the goodness-of-fit was not the main goal in the model development of this study.

### 6.5.6 Moderate values of the squared multiple correlation

The structural models in the effects of PBL on graduates' competencies generally showed moderate squared multiple correlations ($R^2$) (see Table 6.10). Cohen (1977) suggested that correlation values around .5 are considered to be large, around .3 is medium and .1 is small. To put it in squared correlation the values are: around .25 for large, around .09 is moderate and around .01 is small.

Even though most of the values could be categorized as moderate, few $R^2$ are relatively small. For example in the effects of PBL components to field-related competencies the $R^2$ is .04 which means that only 4% of the variance in Field-related competencies could be attributed to PBL components.

Table 6.10
Squared multiple correlations of the effects of PBL on graduates' competencies

| Model | $R^2$ |
|---|---|
| The effects of PBL on... | |
| Personal and organisational competencies (1A) | .15 |
| Personal and organisational competencies (1B) | .07 |
| Field-related competencies (2A) | .11 |
| Field-related competencies (2B) | .04 |
| Leadership competencies (3A) | .14 |
| Leadership competencies (3B) | .08 |
| Interpersonal competencies (4A) | .18 |
| Interpersonal competencies (4B) | .08 |

Regarding the small values Cohen (1977) stated that in social science the values are indeed small compared to physical science. Therefore Cohen (1977) also suggested that the categorisation must be understood relatively, not absolutely. Relative here means that the researcher should also consider the $R^2$ values of other studies in the same area. Cohen stated that the continuum of the values perhaps ranging from personality-social psychology, sociology

and cultural anthropology, to a more controlled studies in experimental and physiological psychology.

It is customary to caution that a low correlation is not very important even if it is statistically significant (Aron & Aron, 2003). However, statistical effect size (including *r*) is not the only way to determine the importance of an effect. Prentice and Miller (1992) suggested alternative methods of demonstrating the importance of an effect in which more attention is put on research design rather than on analysis. Prentice and Miller (1992) assert two conditions that demonstrate the importance of effect. The first is by showing that even the most minimal manipulation of the independent variable still attributed for some variance in the dependent variable. The second approach is by choosing a dependent variable that seems difficult to be influenced by independent variable.

In this study perhaps the second condition could be identified. Graduates' competencies are a complex domain with many variables involved (e.g. students' socio biography, prior higher education activity, motivation, further training and life experiences).

In relation to the small effect size, PBL is known also as a complex domain to be researched. Norman and Schmidt (2000) argue that the small effects and inconclusive findings in PBL research is because PBL interventions are inadequately grounded in theory, in real environments, complex and multifactorial, many unseen interacting forces, and using outcomes so distant from the learning setting, therefore any predicted effects would inevitably be diffused by myriad unexplained variables. Norman and Schmidt (2000) further emphasized that: "the fact that any significant effects have been observed is evidence of the effectiveness of PBL" (p. 722).

## 6.6 Summary

The purpose of this chapter was to depict the effect of PBL characteristics on specific graduates' competencies. This purpose was triggered by the need to provide empirical data on the effect of PBL on competencies. With the empirical data on the effect of PBL on competencies, higher education institutions and educators can make informed choices in adapting PBL to their particular context and educational goals. This was achieved by presenting the result of structural model testing of the effect of PBL.

The result of the tested model showed that each characteristic of PBL has a positive impact on specific graduate competencies. This result not only adds a new insight to the body of research in PBL and its effects but also has some practical applications for the implementation of PBL. The practical applications are useful for institutions that want to implement specific PBL components to achieve their educational goals and in the same time fit with their limited resources.

The results of this study can also help educators who want to implement PBL components in their courses even without the support of the institution. Educators can make informed choices on which component of PBL should be applied according to their courses' context and the educational goals.

Even though this study suggested the possibility to implement specific PBL components to acquire improvement in specific competencies, the implementation of all components indeed leads to better effects on graduates' competencies. Nevertheless the results of the analysis suggest that it is possible to exclude Small group in the PBL method. This is considering that: (1) Small group has the smallest effect on Interpersonal competencies (Table 6.9) and (2) Small group affected only Interpersonal competencies. Two other PBL components (SCL and Real-world problems) significantly affected Interpersonal competencies. Therefore, when Small group is omitted, Interpersonal competencies are still affected by SCL and Real-world problems. Prior studies also documented the implementation in large classes or without Small group component (e.g. Klegeris & Hurren, 2011; Pastirik, 2006; Woods, 1996).

# 7 Summary and conclusion

This chapter integrates various issues raised in the present study. The chapter's sections synthesize the empirical findings of the study and its practical implications. The limitations of the study along with recommendations for future research will be presented afterwards. The chapter is closed by a final remark.

This study set out to add to the discussion of the relationship between higher education and the requirements of the world of work with an emphasis on the effects of learning environment on educational outputs. The study investigated the effects of problem-based learning (PBL) on graduates' competencies. Identification of PBL components was also conducted in the process which was represented by the development of the PBL implementation questionnaire.

PBL certainly has been one of the major topics in the history of medical education. Since the introduction in the beginning of 70s many medical school have been implementing PBL. There are also vast amounts of research studies conducted on PBL. Among other themes, research on the effectiveness of PBL (e.g. comparison between PBL and non-PBL) has been very appealing, not only for researchers but also for higher education institutions and society (e.g. policy makers, tax payers, employers, parents, and prospective students). This is as a consequence of the pressure for higher education institutions to provide accountable data on the quality of teaching and learning outcomes (Altbach, et al., 2009; Nusche, 2008). Additionally, society also demands that higher education put more emphasis on the professional relevance of the study programs and employability while also being concerned for the benefit of academic learning beyond the labour market (Teichler, 2008).

Despites the abundance of research on the effects of PBL on educational outcomes there are also challenges and critiques regarding PBL research methodology. For example, there is no

clear definition of PBL which leads to difficulty in the research operationalisation. In addition, higher education institutions also have been modifying PBL to meet their limited resources. One of the main causes of this is the high cost of full PBL implementation.

There have been discussions and suggestions to improve this condition (e.g. Albanese, 2000; Hmelo-Silver, 2004; Hmelo-Silver, et al., 2006; Newman, 2003). One of the possible solutions is to implement only certain components of PBL to cope with the limited resources of the institution. To achieve this, there is a need to explore the effect of each PBL component to educational output. Through this information, higher education institutions (HEIs) or educators could choose certain PBL components that are suitable for the educational goals. However, the identification of PBL components should be conducted first.

The first objective of this study was to identify PBL components. This was done by the development of the PBL implementation questionnaire. The components of PBL were developed based on theoretical foundations and prior studies. The indicators of each component were developed afterwards. Certain procedures, including confirmatory factor analysis, were carried on to assure the validity and reliability of the questionnaire. A similar procedure was conducted in developing graduates' competencies questionnaire.

The second objective of this study was to determine the effect of each identified PBL component on specific graduates' competencies. With this information, higher education institutions and educators can make informed choices in adapting PBL to their particular context and educational goals.

The analysis was based on quantitative data collected in the survey of medicine graduates of Gadjah Mada University, Indonesia. Graduates' rating is considered as one of the best sources of data in researching the relation of higher education to work. A graduate survey offers a unique perspective from graduates which cannot be replicated by other customary measures within the system.

## 7.1 Empirical findings

Based on prior studies, six components of PBL were identified (i.e. Student-centred learning, Small group, Teacher as facilitator, Problem as stimulus, Real-world problem, and Self-

directed learning) with a total of 30 indicators. Graduates' competencies consisted of four components (i.e. Personal and organisational competencies, Leadership, Field-related competencies, and Interpersonal competencies) with a total of 28 indicators.

Chapter 5 reported the validity and reliability of PBL implementation and the graduates' competencies questionnaire. Based on the result of confirmatory factor analysis (CFA) it can be concluded that the PBL implementation and graduates' competencies are valid and reliable questionnaires.

Chapter 6 investigated the effects of each PBL component on graduates' competencies by using structural models. The results showed that each PBL component has certain effects on graduates' competencies. The Student-centred learning and Small group components affected Interpersonal competencies. Problem as stimulus affected Leadership. Real-world problems affected Personal and organisational competencies and Interpersonal competencies. Teacher as facilitator affected Leadership competencies. Self-directed learning affected Field-related competencies.

The highest impact of PBL on graduates' competencies were found in the effect of Problem as stimulus on Leadership followed by the effect of Teacher as facilitator on Leadership, and Real-world problems on Personal and organisational competencies. The lowest effect was found in the effects of Small group on Interpersonal competencies (see Table 6.9 for the complete statistics).

These findings supported prior PBL studies in which PBL positively affected graduates' competencies (Cohen-Schotanus, et al., 2008; Hoffman, et al., 2006; Patria, 2011; Prince, et al., 2005; Schmidt, et al., 2006). The present study has not merely replicated prior studies on the effectiveness of PBL but also presented improvements on the previous studies. First, the present study identified PBL components based on theory as well as empirical data. Second, this study used structural equation modelling based on latent variables, while prior studies used a variable as a proxy of a construct. Third, this study used confirmatory factor analysis to validate the latent structure of the measurement therefore provided better evidence of validity. Fourth, this study used graduate survey data which is suitable for analysing PBL effects in the frame work of the relationship between higher education and the world of work.

## 7.2 Practical implications

As stated earlier, the result of this study showed that the PBL implementation questionnaire is a valid and reliable measurement. Therefore, the questionnaire could be used to evaluate the implementation of PBL based on graduates' perception. Higher education institutions (HEIs) could evaluate the implementation of each PBL component based on the perspective of students or graduates. The results of the evaluation would be meaningful input to improve PBL process in the institution.

To put this in the context of PBL implementation in Gadjah Mada University (UGM), graduates' rating of Teacher as facilitator and Problem as stimulus were the lowest among all PBL components (see Section 4.2.2). To some extent this could explain why the graduates reported a low rating on Leadership competencies (see Section 4.5). Teacher as facilitator and Problem as stimulus are two components that significantly affected Leadership competencies (Section 0). Therefore based on this evaluation UGM should improve their tutors' qualification.

This kind of evaluation should be conducted regularly. One possibility is to include the PBL evaluation in the institution's graduate survey. The PBL questionnaire is relatively short therefore it could be included in the graduate survey questionnaire.

Each PBL component significantly affected certain set of graduates' competencies. These results provided practical suggestions for higher education institutions (HEIs) in implementing PBL.

1. HEIs should not start implementing PBL by establishing Small group or small classes because it has the smallest effect on graduates' competencies. This applies especially when the HEI has limited resources since establishing small group learning (small classes) is known to be costly (Albanese & Mitchell, 1993; Nandi, et al., 2000).

2. If HEIs choose to implement only few PBL components, they should concentrate on the implementation of Problem as stimulus, Teacher as facilitator, and Real-world problem. These PBL components have the highest effect on graduates' competencies.

3. To improve graduates' leadership competencies, HEIs should incorporate Problems as the stimulus of learning and should promote the role of Teacher as facilitator.

4. To improve graduates' field-related competencies, HEIs should focus on the implementation of Self-directed learning.

5. To improve graduates' Personal and organisational competencies, HEIs should focus on the implementation of Real-world problem.

6. If HEIs want to improve students' or graduates' interpersonal competencies, they should concentrate more on the implementation of Student-centred learning, Real-world problems and the development of Small-group learning.

These practical implications are also suitable for educators or teachers who want to implement PBL in their courses or classes. Educators can apply specific PBL components based on their context even though their institution is still using a conventional curriculum.

## 7.3 Limitations of the study

There are few limitations in this study that should be noted. The limitations are mainly related to the nature of the study which was based on graduates' retrospective perspective. Graduates rated their responses on PBL implementation in their institution up to three years after graduation. To increase the accuracy of the retrospective rating this study included also the new graduates (eight months after graduation). Nevertheless, there is a possibility that graduates responses might be less accurate over three years time span.

Self rating data are affected by some biases, for instance graduates overestimating or underestimating their responses. There is also a possibility of social desirability bias, where graduates responses are influenced by the tendency to be viewed favourably by others.

It should be noted also that there is a concern about the accuracy of self-assessment (Eva, Cunnington, Reiter, Keane, & Norman, 2004). The accuracy of self-assessment is poor especially on judging complex phenomena (Rozenblit & Keil, 2002). For example, graduates' judgement of their understanding of particular facts (e.g. Did you experience problem-based learning (PBL) process during your study?) is relatively accurate compared to their self-assessment regarding their understanding of complex phenomena (e.g. How is the implementation of student-centred learning in your higher education?). This limitation was

reduced in this study by simplifying the PBL evaluation, i.e. splitting the evaluation of the PBL by its components or factors.

Despite its limitations, using graduates' perspective data in investigating the effect of PBL has its own advantage. Teichler and Schomburg (2013) stated that even though limited by certain bias and validity, graduates' rating is viewed as superior to other measures because it is more specific, more direct to the point of competencies and measures links between competencies and work tasks. Graduate data also give a unique perspective because graduates have intensively been part of the academic learning environment and at the same time they provide information about the labour market (Vermeulen, 2006).

Even though there is no single agreement about the cut off value of survey's response rate, researchers generally agree that the higher the response rate the better. Groves et al. (2004) stated that non-response and refusal rate steadily increase over years, e.g. the non-responses of a Survey of Consumers were increasing from around 30% in 1980 to more than 40% in 1999. This means the response rate was around 60% in 1999. More recent data showed that response rate is declining even more. For example, the CHEERS project (Careers after Higher Education – a European Research Study), a survey of about 36.000 graduates in 11 European countries and Japan, yielded of about 40% response rate (Teichler, 2007). Another graduate survey of around 36 thousands graduates in Germany reported a response rate of 47% (KOAB, 2009).

The response rate of the present study (39.1%) indeed was rather low compared to the one from Consumers Survey (Groves, et al., 2004) and KOAB (2009). Nevertheless, both surveys were not specifically addressing medicine graduates. Surveys on medicine graduates yielded a variety of response rates. The high ones reached 71% (Antepohl, Domeij, Forsberg, & Ludvigsson, 2003), 80% (Peters, et al., 2000), and even 87% (Shin, et al., 1993). In Shin's (1993) study it was possible to reach a high response rate possibly because it was a small survey with 96 selected respondents from two medical schools.

The surveys with a lower response rate only reach a response rate of 39% (Schmidt & van der Molen, 2001). A more recent graduate survey on medicine graduates reached only a 35% response rate (Buddeberg-Fischer, Stamm, & Klaghofer, 2010). Another recent survey on two cohorts of medicine graduates yielded a response rate of 37% and 34% (Watmough, et al.,

2012). Compared to these recent response rates of medicine graduate surveys, the response rate of the present study is still acceptable even though not optimal.

As stated before in Chapter 3, the response rate in the present study was not optimal and mainly related to the coverage error and non response error caused by inaccurate graduates' email addresses and phone numbers. These errors could affect the inference drawn from the analysis (Groves, et al., 2004). However, Groves (2004) further stated that when the causes of survey participation are unrelated to the survey statistics, non respondents and respondents will have similar values on the statistics. In this case, survey estimates will be similar regardless the response rate (Groves, et al., 2004).

One way to check that the non respondents have the same statistics as the respondents is to check the representativity of the data collected. One variable that could be used to check the representativity is gender. Another possibility is to use the grade point average (GPA) score because the variable existed in both databases (graduates' contact database and the survey data), however the GPA information in the graduates' address database were incomplete. As stated before in Chapter 4, the descriptive statistics of gender showed a representative data compared to the population. Gender proportion of the dataset (56.1% female and 43.9% male) was equal to the proportion of the population (54.2 % female and 45.8% male). This means that the variance in the sample is similar to the population. It can be concluded that even though with 39.1% response rate, the data in this study reflected the data of the whole population.

Nevertheless this explains only the representativity of subjects' characteristics (i.e. gender). The representativity of the content-related variables (e.g. graduates' evaluation of PBL) remains unknown. Hence, whether the non-response graduates also have similar responses with the data collected in this study could not be confirmed. There was also no possibility to check the representativity of content-related variables because the prior data were not available.

Another constraint in this study is that the structural models were tested with data from one institution. To test the generalization, the models should be tested with data from other institutions. This study was previously planned for more than one medical school. However, after evaluating the research process it was decided to take only one institution. This

decision was made considering that: (1) additional institutions were not achievable due to the time constraint of the study, and (2) the data collected already consisted of enough sample for model testing. Furthermore there was a concern that adding more institutions will lead to, as noted by Teichler and Schomburg (2013), graduate survey customary over-interpretation, e.g. institution A is better in PBL implementation than institution B.

Another concern is related to the low goodness-of-fit (GOF) in the models of the effects of PBL on graduates' competencies, especially in the restricted models (model B). However, this could be justified because model B was introduced specifically to investigate further the effect of PBL on graduates' competencies. Therefore the aim is not to get the best model or the best GOF statistics. The results of Model B showed that PBL components had significant effects on specific graduate competencies which were not revealed in Model A.

Even though high GOF index was not the main aim in the structural models, the GOF index of the models were close from the requirement of a fit model. Even in some models the GOF index already fulfilled the requirement of a fit model based on a more traditional standard. In other models, with a minor respecification, a fit model would be easily achieved. However, model respecification was not conducted because the main goal is to investigate the effect of PBL on competencies and not to develop a fit model. Additionally, the respecification would violate the underlying theory used in the model development.

## 7.4 Further research

The structural models in this study shed light on the identification of PBL components and their effects on graduates' competencies. Further PBL research using structural models should include other relevant confounding variables. The inclusion of other variables would be of great help in understanding the effects of PBL on educational outputs. The relevant variables are notably, (a) the socio-biographic background and characteristics of the students or graduates, (b) the activity during study, (c) learning before and outside higher education, and (d) other elements related to study condition and provision.

As mentioned earlier, the structural models in this study were tested with data from one institution. Further research should include data from other medical institutions, thus the proposed concept of this study (Figure 1.2) would be more applicable. With the inclusion of

another dataset it is possible to confirm the difference of PBL implementation between two or more institutions. PBL implementation should be an attribute of institution. This means that the difference in PBL implementation should be caused by different levels or quality of PBL implementation between institutions and not because of the difference in graduates' perception.

In addition, further research should investigate the development of standardized factor score and total score of PBL implementation. As discussed in Section 6.2.1, factor score calculation is not easy because of issues like calculation errors and indeterminacy problem. However, the development of a standardized score is important because it opens the possibility for further evaluation of PBL. Each institution will know where it stands among other institutions in term of PBL implementation. Furthermore, the standardized score would not only provide a better method in researching comparison between PBL and non-PBL, but also open the possibility for international comparison.

## 7.5 Conclusion

Despite the limitations this study prevails in enriching research in the relationship between higher education and the requirements of the world of work, especially on the effects of problem-based learning (PBL) method on graduates' competencies. This study successfully identified the components of PBL which manifested in a valid and reliable PBL implementation measurement. This is a meaningful finding because it could be useful as a tool for evaluating the implementation of PBL.

With further development, e.g. constructing a standardized factor score and total score of PBL implementation, the PBL implementation questionnaire could be used in PBL effectiveness research (comparison of outcomes between PBL and non-PBL). It could also open the possibility to conduct PBL implementation comparison between institutions.

The study also documented the effects of each PBL component on certain graduate competencies. These results not only affirmed former results about the positive effects of PBL on graduates' competencies but also have practical implications for higher education institutions, educators and society in general. The results of the identification of PBL

components could guide higher education institutions and educators in the implementation of PBL.

This study also suggested that PBL research should be more inclined not only toward the fortitude of finding its effectiveness (e.g. comparison to non-PBL method), but more importantly also directed toward the improvement of the research method.

Higher education institutions should implement PBL based on the full understanding of its components, processes, effects, and also consider the context of the institution. Only with comprehension of the overall PBL method could higher education institutions achieve their educational goals even when restricted with limited resources. Furthermore, higher education institutions should not only be satisfied with the implementation of PBL, they should evaluate the PBL regularly and strive to provide a better learning environment for the students.

# 8 References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# 9 Appendix

Fakultas Kedokteran
Universitas Gadjah Mada

INCHER-KASSEL
International Centre for Higher Education Research Kassel

# Graduate Survey
# Faculty of Medicine UGM

**Graduate survey for 2009-2011 graduates**

We have prepared two versions of this questionnaire for you to choose from:
an online version and this paper version.

If you want to fill in the paper questionnaire, please enter the code from the cover letter in the box below so that we can delete it from the online survey.

☐☐☐☐☐☐

On the next page you will find the instructions on how to fill in this questionnaire.
If possible, please complete the questionnaire in the following two weeks, and send it back to us using the addressed envelope included in the package you received.

Bagian Pendidikan Kedokteran Fakultas Kedokteran Universitas Gadjah Mada
Gedung Radiopoetra, Lt. 6 Sayap Barat
Komplek Fakultas Kedokteran
Jl. Farmako, Sekip Utara, Yogjakarta 55281
http://www.gradmedic.com

## Guidelines

Please answer all questions in the given order by either ticking the box next to your answer or by filling in text in the given text field with legible handwriting.

Please use a ballpoint pen or fountain pen, no pencils or light felt-tipped pens.

In most cases you will have to tick the appropriate box. If more than one box can be ticked, there will be an additional note stating "multiple answers possible".

In some cases, you will note that the questionnaire suggests that you disregard a certain question(s) not applicable to you (e.g. *Please continue with question* A6).

If you would like to correct your answer please color the mistaken/wrong answer black, tick the box with the new answer and add an underscore below that box.

If the given text field is insufficient for your replies, please attach an additional sheet of paper.

The following list provides an overview of the questionnaire's content:

A Prior to higher education
B Study activities
C Sequence of professional activities and job search
D Information about current activities, employment and work
E Competencies
F Relationship between higher education and work
G Professional orientation and satisfaction
H Socio-biographic data
I Contact with Faculty of Medicine UGM
K Comments/recommendations

## A. Prior to higher education

*Please provide information on your educational development and your work experiences before your first enrolment in FK UGM*

**A1 When did you finish your study in high school?**

1 ☐☐☐☐

**A2 How many years of schooling did you spend in high school?**

1 ☐ Years

**A3 How do you rate your overall grades in high school?**

| | Very low | | | | Very high |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ |

**A4 Where is the location of your high school where you graduated from? (City and province)**

1 ☐ Indonesia
City: .....
Province: .....
2 ☐ In another country: .....
(please specify)

**A5 Prior to your first enrolment in higher education, have you received any education/training/apprenticeship abroad?**

1 ☐ No
2 ☐ Yes,
For approximately: ☐☐ Years, ☐☐ Months
Country: .....
(please specify)

**A6 What kind of admission types you use when you enrolled in FK UGM?** Z2

1 ☐ PBUPD (Penelusuran Bibit Unggul Pembangunan Daerah)
2 ☐ PBUB (Penelusuran Bibit Unggul Berprestasi)
3 ☐ PBS (Penjaringan Bibit Unggul Swadana)
4 ☐ PBOS (Penelusuran Bakat Olahraga dan Seni)
5 ☐ UGM (Ujian masuk UGM)
6 ☐ SNMPTN / SPMB (Seleksi Nasional Masuk Perguruan Tinggi Negeri)
7 ☐ PBUTM (Penjaringan Bibit Unggul Tidak Mampu)
8 ☐ Other: .....
(please specify)

## B. Study activities

***The following questions refer to your study activities in FK UGM until you were awarded a bachelor degree in medicine (S.Ked). Please exclude your activities in the clinical rotation (Co-asst.).***

**B1 What was the start and graduation date of your study in medicine?**

1 **START (month/year):** ☐☐ / ☐☐☐☐
2 **END (month/year):** ☐☐ / ☐☐☐☐

**B2 What kind of medical program did you attend?**

1 ☐ Regular program
2 ☐ International program
3 ☐ Other: .....
(please specify)

**B3 How many months between first enrolment and graduation did you spend <u>predominantly</u> on:**

| | Duration (months) | |
|---|---|---|
| 1 | ☐☐ | Employment/work not related to study or possible future work |
| 2 | ☐☐ | Employment/work related to study or possible future work |
| 3 | ☐☐ | Work placement, internship (as part of your degree course) |
| 4 | ☐☐ | Child rearing, family care |
| 5 | ☐☐ | Not employed, seeking employment |
| 6 | ☐☐ | Other: ..... |

(please specify)

**B4 Did you spend time abroad during the time of your study *(in order to work or to study)*?**

1 ☐ Yes
2 ☐ No → *Please continue with question B6*

**B5** **If you stayed abroad: please state *(for each period abroad, if you have spent more than one)* the countries, the duration and the activities.**

| | A. Country *(please specify)* | B. Duration *(months)* | C. Major activity *(multiple replies possible)* |
|---|---|---|---|
| 1 | ..... | ☐☐ | ☐ Study (classes, self-study, work on thesis etc.)<br>☐ Work placements/internships<br>☐ Other (please specify): ..... |
| 2 | ..... | ☐☐ | ☐ Study (classes, self-study, work on thesis etc.)<br>☐ Work placements/internships<br>☐ Other (please specify): ..... |

**B6** **During your study time, did you involve in an organization (students/social/youth/religion)?**

1 ☐ Yes

2 ☐ No → *Please continue with question B8*

**B7** **How active were you in the organization?**

| | Not at all | | | | To a very high extent |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ |

**B8** **On average, how many hours per week did you spend on the following activities during the course of your study?**

| | During semesters (hours) | During semester breaks (hours) | |
|---|---|---|---|
| 1 | ☐☐ | ☐☐ | Attending courses/classes |
| 2 | ☐☐ | ☐☐ | Study activities outside of courses/classes (group work, preparation, rehearsal of material etc.) |
| 3 | ☐☐ | ☐☐ | Preparation for exams |
| 4 | ☐☐ | ☐☐ | Working (no internships) |
| 5 | ☐☐ | ☐☐ | Family-related duties |
| 6 | ☐☐ | ☐☐ | Other:..... (please specify) |

**B9** **How do you rate the study provision and study conditions you experienced in the course of study? (Please rate only your experience in undergraduate study)**

| | Very bad | | | | Very good | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Academic advice offered in general |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Assistance/advice for your final examination |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Course content of major |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Variety of courses offered |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Design of degree program |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Testing/grading system |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Opportunity to choose courses and areas of specialisation |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Practical emphasis of teaching and learning |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Teaching quality |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Chances to participate in research projects |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Research emphasis of teaching and learning |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Provision of work placements and other work experience |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Opportunity of out-of-class contacts with teaching staff |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Contacts with fellow students |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Chance for students to have an impact on university policies |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Equipment and stocking of libraries |

to be continued…

continued

| | Very bad 1 | 2 | 3 | 4 | Very good 5 | |
|---|---|---|---|---|---|---|
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Supply of teaching material |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Quality of technical equipment (e.g. workstations, wlan, internet, measuring instruments, etc.) |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Laboratories |
| 20 | ☐ | ☐ | ☐ | ☐ | ☐ | Expert advice |
| 21 | ☐ | ☐ | ☐ | ☐ | ☐ | Other:..... (please specify) |

## B10 To what extent did your work experiences *(employment, internships etc.)* during study tie up with the content of your studies

| | Not at all 1 | 2 | 3 | 4 | To a very high extent 5 | Not applicable, no work experiences |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

## B11 How do you rate the following advisory and guidance elements in your study course?

| | Very bad 1 | 2 | 3 | 4 | Very good 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Professional advice and guidance provided by teaching staff |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Discussion of written examinations, assignments etc. |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Individual occupational advice in your field |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Individual study advice in your field |

## B12 Did you experience Problem-Based Learning (PBL) process during your study?

1 ☐ Yes, the whole study course

1 ☐ Yes, approximately ☐☐ % of the study course

2 ☐ No → *Please continue with question B14*

## B13 Generally how satisfied are you with the implementation of PBL curriculum?

| | Very dissatisfied 1 | 2 | 3 | 4 | Very satisfied 5 |
|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ |

## B14 To what extent were the following statements match with the conditions in your study course?

| | | Not at all 1 | 2 | 3 | 4 | To a very high extent 5 |
|---|---|---|---|---|---|---|
| | **Student-centred learning** | | | | | |
| 1 | Students are responsible for their own learning | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | Students are actively involved in the process of learning | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | Students have autonomy in the process of learning | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | Teacher is not the main source of information | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | Equal role of teacher and students (interdependence) | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | Emphasis on deep learning | ☐ | ☐ | ☐ | ☐ | ☐ |
| | **Small group** | | | | | |
| 1 | Learning process occurs in a small group (5-9 students). | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | The group size is appropriate to stimulate group discussion | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | The learning groups have positive atmosphere (non-threatening) | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | The group size is appropriate to encourage active student participation | ☐ | ☐ | ☐ | ☐ | ☐ |

to be continued…

continued

| | | Not at all | | | | To a very high extent |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| | **Problems as stimulus** | | | | | |
| | The problems in the tutorial process | | | | | |
| 1 | …match with students' level of knowledge | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | …stimulate thinking, analysis, and reasoning | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | …assure self-directed learning | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | …activate students' prior knowledge | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | …lead to the discovery of the learning objectives | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | …arouse students' curiosity | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7 | …use appropriate vocabulary | ☐ | ☐ | ☐ | ☐ | ☐ |
| | **Real world problems** | | | | | |
| | The problems in the tutorial process | | | | | |
| 1 | …are realistic | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | …are clinically relevant | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | …related to a public health topic | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | …generate multiple hypotheses about their cause and solution | ☐ | ☐ | ☐ | ☐ | ☐ |
| | **Teacher as facilitator** | | | | | |
| 1 | The tutors have a clear picture about their strengths/weaknesses as a tutor | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | The tutors are clearly motivated to fulfill their role as a tutor | ☐ | ☐ | ☐ | ☐ | ☐ |
| | The tutors stimulate the students | | | | | |
| 3 | …to summarize what they had learnt in their own words | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | …to search for links between issues discussed in the tutorial group | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | …to understand underlying mechanisms/theories | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | …to apply knowledge to the discussed problem | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7 | …to apply knowledge to other situations/problems | ☐ | ☐ | ☐ | ☐ | ☐ |
| 8 | …to give constructive feedback about the group work | ☐ | ☐ | ☐ | ☐ | ☐ |
| 9 | …to evaluate group co-operation regularly | ☐ | ☐ | ☐ | ☐ | ☐ |
| | **Self-directed learning** | | | | | |
| 1 | Students take initiative in diagnosing their learning needs | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | Students formulating the learning goals | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | Students decide the resources (human and material) for learning | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | Students choose appropriate learning strategies | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | Students evaluate the accuracy and value of the resources | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | Students self-monitor their learning progress | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7 | Students self-assess their learning outcome | ☐ | ☐ | ☐ | ☐ | ☐ |

## B15 What is your Bachelor's GPA (General Performance Average)?

1 ☐,☐☐

## C. Sequence of professional activities and job search

*The following questions refer to the period after graduation from FK UGM with a medical doctor title (dr.).*

**C1 Did you ever seek a job since graduation?** *Please exclude temporary non study related job*

1 ☐ Yes, in medical and health sector → *Please continue with question C2*
2 ☐ Yes, not in medical and health sector → *Please continue with question C2*
3 ☐ No, I continued studying to master degree → *Please continue with question C7*
4 ☐ No, I continued a job I had prior to studying → *Please continue with question C7*
5 ☐ No, I found a job without searching → *Please continue with question C6*
6 ☐ No, I became self-employed → *Please continue with question C7*
7 ☐ Other:.....
(please specify)

**C2 How did you look for a job after graduation?** *Multiple replies possible*

1 ☐ 1. I applied for an advertised vacancy
2 ☐ 2. I contacted employers without knowing about a vacancy
3 ☐ 3. I was approached by an employer
4 ☐ 4. I contacted a public employment agency
5 ☐ 5. I contacted a commercial employment agency
6 ☐ 6. I enlisted the help of the careers/placement office of my institution of higher education
7 ☐ 7. I enlisted the help of teaching staff of the institution of higher education
8 ☐ 8. I established contacts while working during the course of study
9 ☐ 9. I used other personal connections/contacts (e.g. parents, relatives, friends)
10 ☐ 10. I started my own business/self-employment
11 ☐ 11. Other: .....
(please specify)

**C3 Which method was the most important one for you to get a job after graduation?** ***Please fill in the item number from question C2***

1 ☐☐ The most important strategy *(see question C2)*
2 ☐ Not applicable, I have not found a job after graduation → *Please continue with question C7*

**C4 How many employers did you contact (by e.g., letter) before you took up your first job after graduation?**

1 ☐☐☐☐ Approximate number of employers contacted

**C5 How many months have you sought all-together *(before or after graduation)* for your first job after graduation, which you consider not to be a casual job?**

1 ☐☐ Months of job search
2 ☐ Not applicable, I am not employed yet

**C6 How important, according to your perception, were the following aspects <u>for your employer</u> in recruiting you for your employment after graduation, if applicable?**

| | Not at all important 1 | 2 | 3 | 4 | Very important 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Field of study |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Main subject/specialisation |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | GPA |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Practical/work experience acquired during course of study |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Reputation of the institution of higher education |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Experience abroad |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | English proficiency |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Other foreign language proficiency |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Computer skills |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Recommendations/references from third persons |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Personality |

**C7** **Please summarize your predominant activities since you got bachelor degree in medicine (S.Ked).** ***Multiple answers possible.***

1 ☐ **Clinical rotation**

Begin date (month/year) ☐☐/☐☐☐☐ ☐ Not yet completed

End date (month/year) ☐☐/☐☐☐☐

GPA: ☐,☐☐

2 ☐ **Post graduate studies (Master degree)**

Name of the Program: …… Institution: ……..

Begin date (month/year) ☐☐/☐☐☐☐ ☐ Not yet completed

End date (month/year) ☐☐/☐☐☐☐

GPA: ☐,☐☐

3 ☐ **Doctorate**

Name of the Program: …… Institution: ……..

Begin date (month/year) ☐☐/☐☐☐☐ ☐ Not yet completed

End date (month/year) ☐☐/☐☐☐☐

4 ☐ **Specialisation program**

Institution: ……

Specialisation:

| | | |
|---|---|---|
| ☐ Paediatrics | ☐ Ophthalmology | ☐ Paediatric surgery |
| ☐ Surgery | ☐ Psychiatry | ☐ Orthopaedic |
| ☐ Internal medicine | ☐ Radiology | ☐ Urology |
| ☐ Obstetrics/Gynaecology | ☐ Neurology | ☐ Cardiology |
| ☐ Anaesthesiology, Reanimation | ☐ Otolaryngology (ENT) | ☐ Other:…….. |
| ☐ Forensic and Medico-legal | ☐ Anatomic Pathology | …….. |
| ☐ Dermatology and Venereal disease | ☐ Clinical Pathology | (please specify) |

Begin date (month/year) ☐☐/☐☐☐☐ ☐ Not yet completed

End date (month/year) ☐☐/☐☐☐☐

5 ☐ **Parental leave**

For Approximately: ☐ Years, ☐☐ Months

6 ☐ **Employment / Self-employment**

For Approximately: ☐ Years, ☐☐ Months

7 ☐ **Unemployment**

For Approximately: ☐ Years, ☐☐ Months

8 ☐ **Other**: ..... For Approximately: ☐ Years, ☐☐ Months

(please specify)

## D. Information about current activities, employment and work

*The following section refers to your **current employment** (exclude temporary and non study related jobs, but include paid occupational training like internships, medical residency, etc.).*

**D1 Are you currently employed/self-employed?**

1 ☐ Yes, I am employed
2 ☐ Yes, I am self-employed → Please continue with question D4
3 ☐ No → Please continue with question D13

**D2 What type of contract do you have in your current job?**

1 ☐ Permanent
2 ☐ Temporary
3 ☐ Other:.....
(please specify)

**D3 What is the number of contract hours in your current job?**

1 ☐☐ Weekly working hours according to contract

**D4 What is the number of actual weekly working hours in your current job**

1 ☐☐ Actual weekly working hours

**D5 How would you describe your current professional situation? *Multiple replies possible*.**

1 ☐ I have a regular employment
2 ☐ I am self-employed
3 ☐ I have casual jobs related to medical and health sector
4 ☐ I have casual jobs not related to medical and health sector
5 ☐ I have more than one job
6 ☐ Other:.....
(please specify)

***If you have more than one job, please refer to your major job.***

**D6 When did you start your current job**

1 Month: ☐☐ Year: ☐☐☐☐

**D7 Please state the kind of your current employer/ institution.** *Please mark one single item only*

1 ☐ Governmental institution
2 ☐ Non Profit Organisation
3 ☐ Private company
4 ☐ Self employed
5 ☐ Other:.....
(please specify)

**D8 In which environment are you working now?**

1 ☐ Medical practice
2 ☐ University
3 ☐ University hospital
4 ☐ Regional hospital
5 ☐ International hospital
6 ☐ Medical practice in private sector (e.g., company physician)
7 ☐ Research organisation
8 ☐ Other medical and health environment: .....
(please specify)
9 ☐ Other Non-medical and health environment: .....
(please specify)

**D9 What is your current job title?** *Please fill in the exact job description, e.g. PTT doctor, physician in hospital, social worker, etc.*

.....

.....

.....

**D10 What is your main task in your current job?** *Please specify the exact description, e.g. providing medical service in rural area, teaching, tutoring, R & D, etc.*

.....

.....

.....

**D11 What is your approximate monthly gross income?**

| | | Million rupiah |
|---|---|---|
| 1 | from your current major job (including overtime and extra payments) | ☐☐☐,☐☐ |
| 2 | from other jobs | ☐☐☐,☐☐ |

**D12 Where are you currently employed / self-employed?**

1 ☐ Indonesia

City: .....

Province: .....

2 ☐ In another country: .....

(please specify)

**D13 How many employments / self-employements have you had altogether since graduation?** *(Including current job and self employment)*

1 ☐☐ Number of employers since graduation

2 ☐ I have not been employed since graduation.

**D14 After graduation, have you:** ***(multiple replies possible)***

1 ☐ considered working abroad

2 ☐ sought employment abroad

3 ☐ actually received an offer to work abroad

4 ☐ actually had regular employment abroad since graduation

5 ☐ actually been sent abroad by your employer on work assignments

6 ☐ None → *Please continue with question D16*

**D15 If you have worked abroad: In which country(ies) and how many months (each)?**

| | **A. Duration** *(months)* | **B. Country** (*please specify)* |
|---|---|---|
| 1 | ☐☐ | ..... |
| 2 | ☐☐ | ..... |

**D16 How often did you read subject related professional/scientific journals during the last 12 months?**

| Never | Seldom | About every three months | Monthly | At least once a week | Everyday |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**D17 How often did you attend professional relevant meetings/conferences during the last 12 months?**

| Never | 1 to 3 times | 4 times and more |
|---|---|---|
| 1 | 2 | 3 |
| ☐ | ☐ | ☐ |

**D18 How often did you use the internet sources for professional relevant information gathering during the last 12 months?**

| Never | Seldom | About every three months | Monthly | At least once a week | Everyday |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

## E. Competencies

**E1 Please, state the extent to which you had the following competencies at the time of graduation (awarded with Bachelor of Medicine, SKed.)**

| | Not at all 1 | 2 | 3 | 4 | To a very high extent 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Broad general knowledge |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Cross-disciplinary thinking/knowledge |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Field-specific theoretical knowledge |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Field-specific knowledge of methods |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Understanding complex social, organisational and technical systems |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Planning, co-ordinating and organising |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Applying rules and regulations |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Economic reasoning |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Documenting ideas and information |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Problem-solving ability |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Analytical competencies |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Reflective thinking, assessing one's own work |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Creativity |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Working under pressure |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Accuracy, attention to detail |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Time management |
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Negotiating |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Working independently |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Working in a team |
| 20 | ☐ | ☐ | ☐ | ☐ | ☐ | Initiative |
| 21 | ☐ | ☐ | ☐ | ☐ | ☐ | Adaptability |
| 22 | ☐ | ☐ | ☐ | ☐ | ☐ | Power of concentration |
| 23 | ☐ | ☐ | ☐ | ☐ | ☐ | Loyalty, integrity |
| 24 | ☐ | ☐ | ☐ | ☐ | ☐ | Critical thinking |
| 25 | ☐ | ☐ | ☐ | ☐ | ☐ | Oral communication skills |
| 26 | ☐ | ☐ | ☐ | ☐ | ☐ | Written communication skills |
| 27 | ☐ | ☐ | ☐ | ☐ | ☐ | Tolerance, appreciating different points of view |
| 28 | ☐ | ☐ | ☐ | ☐ | ☐ | Leadership |
| 29 | ☐ | ☐ | ☐ | ☐ | ☐ | Taking responsibilities, decisions |
| 30 | ☐ | ☐ | ☐ | ☐ | ☐ | Collaboration skills |
| 31 | ☐ | ☐ | ☐ | ☐ | ☐ | Self-directed learning skills |
| 32 | ☐ | ☐ | ☐ | ☐ | ☐ | Coping with uncertainty |

*If you are currently not employed / self-employed, Please go to Question G1*

## E2 Please, state the extent to which you had the following competencies now

| | Not at all 1 | 2 | 3 | 4 | To a very high extent 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Broad general knowledge |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Cross-disciplinary thinking/knowledge |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Field-specific theoretical knowledge |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Field-specific knowledge of methods |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Understanding complex social, organisational and technical systems |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Planning, co-ordinating and organising |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Applying rules and regulations |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Economic reasoning |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Documenting ideas and information |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Problem-solving ability |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Analytical competencies |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Reflective thinking, assessing one's own work |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Creativity |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Working under pressure |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Accuracy, attention to detail |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Time management |
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Negotiating |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Working independently |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Working in a team |
| 20 | ☐ | ☐ | ☐ | ☐ | ☐ | Initiative |
| 21 | ☐ | ☐ | ☐ | ☐ | ☐ | Adaptability |
| 22 | ☐ | ☐ | ☐ | ☐ | ☐ | Power of concentration |
| 23 | ☐ | ☐ | ☐ | ☐ | ☐ | Loyalty, integrity |
| 24 | ☐ | ☐ | ☐ | ☐ | ☐ | Critical thinking |
| 25 | ☐ | ☐ | ☐ | ☐ | ☐ | Oral communication skills |
| 26 | ☐ | ☐ | ☐ | ☐ | ☐ | Written communication skills |
| 27 | ☐ | ☐ | ☐ | ☐ | ☐ | Tolerance, appreciating different points of view |
| 28 | ☐ | ☐ | ☐ | ☐ | ☐ | Leadership |
| 29 | ☐ | ☐ | ☐ | ☐ | ☐ | Taking responsibilities, decisions |
| 30 | ☐ | ☐ | ☐ | ☐ | ☐ | Collaboration skills |
| 31 | ☐ | ☐ | ☐ | ☐ | ☐ | Self-directed learning skills |
| 32 | ☐ | ☐ | ☐ | ☐ | ☐ | Coping with uncertainty |

# F. Relationship between higher education and work

## F1 If you take into consideration your current work tasks altogether: To what extent do you use the knowledge and skills acquired in the course of study

| | Not at all 1 | 2 | 3 | 4 | To a very high extent 5 |
|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ |

## F2 Which academic degree is in your opinion best suited for your current job?

1 ☐ Higher level than professional degree in medicine
2 ☐ The same level with professional degree in medicine
3 ☐ The same level with bachelor in medicine
4 ☐ A lower level than bachelor in medicine
5 ☐ Other: .....
(please specify)

## F3 Taking all aspects into account, to what extent does your current work situation meet the expectations you had when you started your study?

| | Much worse than expected | | | | Much better than expected | Not applicable, I have had no expectations |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

# G Professional orientation and satisfaction

## G1 How important are the following characteristics of an occupation for you personally?

| | Not at all important | | | | Very important | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Largely independent disposition of work |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Opportunity of undertaking scientific/scholarly work |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Clear and well-ordered tasks |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Possibilities of using acquired knowledge and skills |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Job security |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Social recognition and status |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Opportunity of pursuing own ideas |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Good social climate |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Opportunity of pursuing continuous learning |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | High income |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Chances of (political) influence |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Challenging tasks |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Good career prospects |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Enough time for leisure activities |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Co-ordinating and management tasks |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Possibility of working in a team |
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Chance of doing something useful for society |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Variety |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Good chances of combining employment with family tasks |

*If you are currently not employed, Please go to Question H1*

## G2 To what extent the following characteristics of an occupation apply to your current professional situation

| | Not at all 1 | 2 | 3 | 4 | To a very high extent 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Largely independent disposition of work |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Opportunity of undertaking scientific/scholarly work |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Clear and well-ordered tasks |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Possibilities of using acquired knowledge and skills |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Job security |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Social recognition and status |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Opportunity of pursuing own ideas |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Good social climate |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Opportunity of pursuing continuous learning |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | High income |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Chances of (political) influence |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Challenging tasks |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Good career prospects |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Enough time for leisure activities |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Co-ordinating and management tasks |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Possibility of working in a team |
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Chance of doing something useful for society |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Variety |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Good chances of combining employment with family tasks |

## G3 Altogether, to what extent are you satisfied with your current work?

| | Very dissatisfied 1 | 2 | 3 | 4 | Very satisfied 5 |
|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ |

# H. Socio-biographic data

## H1 Gender

1 ☐ Male

2 ☐ Female

## H2 Year of birth

1 19☐☐ Year of birth

## H3 Where do you live today?

1 ☐ Indonesia

City: .....

Province: .....

2 ☐ In another country: .....

(please specify)

## H4 What is your current marital status?

1 ☐ Single

2 ☐ Marriage

3 ☐ Separated

## H5 Highest education of parents and spouse

| | Father | Mother | Spouse | |
|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | Elementary school |
| 2 | ☐ | ☐ | ☐ | Junior high school |
| 3 | ☐ | ☐ | ☐ | High school |
| 4 | ☐ | ☐ | ☐ | Diploma |
| 5 | ☐ | ☐ | ☐ | Bachelor |
| 6 | ☐ | ☐ | ☐ | Professional degree |
| 7 | ☐ | ☐ | ☐ | Master |
| 8 | ☐ | ☐ | ☐ | Doctor |

## H6 Parents' profession

Father: .....

Mother: .....

## H7 Do you have children living in your household?

1 ☐ Yes → How many? ☐☐ Number of children

2 ☐ No

## H8 What is the major activity of your spouse, if applicable? (please choose only one)

1 ☐ Not applicable, I don't have a partner

2 ☐ Employed

3 ☐ Self-employed

4 ☐ Not employed, seeking employment

5 ☐ Professional training

6 ☐ Advanced academic study

7 ☐ Child rearing, family care

8 ☐ Other: .....

(please specify)

## I. Contact with Faculty of Medicine UGM

**I1 What kinds of contact to Faculty of Medicine UGM do you have/wish to have?** *Multiple answers possible*

| | Existing | Wished-for | |
|---|---|---|---|
| 1 | ☐ | ☐ | Newsletters or similar information from FK UGM |
| 2 | ☐ | ☐ | Newsletters or similar information from UGM |
| 3 | ☐ | ☐ | Invitations to festivities and events of UGM |
| 4 | ☐ | ☐ | Invitations to awards presentations by FK UGM |
| 5 | ☐ | ☐ | Professional/scientific contact to UGM |
| 6 | ☐ | ☐ | Participation in the alumni-network of UGM |
| 7 | ☐ | ☐ | Information about offers for further education at UGM |
| 8 | ☐ | ☐ | Contact with teaching staff |
| 9 | ☐ | ☐ | Contact with other graduates |
| 10 | ☐ | ☐ | Other: ..... (please specify) |

## J. Comments/recommendations

**J1 What kind of improvements in Faculty of Medicine UGM would you suggest according to your experiences?**

.....

.....

.....

**J2 Other comments (e.g., regarding the questionnaire)**

.....

.....

.....

**Thank you very much for your cooperation**

Fakultas Kedokteran
Universitas Gadjah Mada

INCHER-KASSEL
International Centre for Higher Education Research Kassel

# Survei Alumni Fakultas Kedokteran UGM

**Survei alumni lulusan tahun 2009-2011**

Kami memiliki kuesioner versi online dan versi cetak yang bisa Anda pilih.

Jika Anda memilih untuk mengisi versi cetak, mohon masukkan kode akses yang Anda dapatkan pada kotak dibawah ini sehingga kami bisa menghapusnya dari versi online.

☐☐☐☐☐☐

Pada halaman selanjutnya tercantum instruksi pengisian kuesioner ini. Bila memungkinkan, kami mohon agar kuesioner bisa diisi dan dikirimkan kembali dalam jangka waktu dua minggu.

Bagian Pendidikan Kedokteran Fakultas Kedokteran Universitas Gadjah Mada
Gedung Radiopoetra, Lt. 6 Sayap Barat
Komplek Fakultas Kedokteran
Jl. Farmako, Sekip Utara, Jogjakarta 55281
http://www.gradmedic.com

## Petunjuk pengisian

Jawablah pertanyaan dengan memberikan tanda silang (X) pada kotak di sebelah pilihan jawaban yang Anda pilih. Untuk jawaban berbentuk tulisan, gunakan tulisan tangan yang mudah dibaca.

Mohon menggunakan bolpen untuk menjawab semua pertanyaan.

Pada sebagian besar pertanyaan Anda hanya perlu memberikan satu pilihan jawaban. Pada pertanyaan yang memungkinkan jawaban lebih dari satu, terdapat keterangan *"Jawaban boleh lebih dari satu."*

Pada bagian tertentu Anda diminta untuk melewati beberapa pertanyaan yang tidak sesuai dengan kondisi Anda (misalnya: Mohon lanjutkan ke pertanyaan B6).

Jika Anda ingin mengkoreksi jawaban Anda, hitamkan kotak yang berisi jawaban yang salah dan berilah tanda silang pada jawaban yang baru.

Bila ruang yang disediakan untuk jawaban teks tidak mencukupi Anda bisa menulisnya di lembar kertas lain sebagai lampiran.

Ikhtisar pertanyaan dalam kuesioner ini

A Sebelum masuk FK UGM
B Aktifitas studi
C Aktifitas profesional dan pencarian kerja
D Aktifitas saat ini dan pekerjaan
E Kompetensi
F Pendidikan tinggi dan dunia kerja
G Orientasi pekerjaan dan kepuasan kerja
H Data sosio-biografi
I Kontak dengan UGM / FK UGM
K Komentar dan saran

## A. Sebelum masuk FK UGM

*Isilah pertanyaan-pertanyaan yang berhubungan dengan pendidikan Anda sebelum masuk ke FK UGM*

### A1 Kapan Anda lulus SMU?

1 ☐☐☐☐

### A2 Berapa tahun Anda sekolah di SMU?

1 ☐ Years

### A3 Secara umum bagaimana nilai-nilai Anda di SMU?

| | Sangat buruk | | | | Sangat baik |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ |

### A4 Dimana lokasi SMU Anda?

1 ☐ Indonesia
Kota: .....
Provinsi: .....
2 ☐ Luar negeri: .....
(mohon jelaskan)

### A5 Sebelum masuk ke FK UGM apakah Anda pernah mengikuti pendidikan/training/magang di luar negeri?

1 ☐ Tidak
2 ☐ Ya
Selama kurang lebih: ☐☐ tahun, ☐☐ bulan
Negara: .....
(mohon jelaskan)

### A6 Anda masuk ke FK UGM melalui jalur:

1 ☐ PBUPD (Penelusuran Bibit Unggul Pembangunan Daerah)
2 ☐ PBUB (Penelusuran Bibit Unggul Berprestasi)
3 ☐ PBS (Penjaringan Bibit Unggul Swadana)
4 ☐ PBOS (Penelusuran Bakat Olahraga dan Seni)
5 ☐ UGM (Ujian masuk UGM)
6 ☐ SNMPTN / SPMB (Seleksi Nasional Masuk Perguruan Tinggi Negeri)
7 ☐ PBUTM (Penjaringan Bibit Unggul Tidak Mampu)
8 ☐ Lainnya: .....
(please specify)

## B. Aktifitas studi

***Pertanyaan di bawah ini berhubungan dengan aktifitas studi di FK-UGM sampai Anda mendapatkan gelar Sarjana Kedokteran (S.Ked). Mohon aktifitas dalam pendidikan profesi kedokteran (co-asst.) tidak disertakan.***

### B1 Kapan Anda mulai kuliah dan kapan Anda diwisuda?

1 **Mulai kuliah (bulan/tahun)**: ☐☐ / ☐☐☐☐
2 **Wisuda (bulan/tahun)**: ☐☐ / ☐☐☐☐

### B2 Program pendidikan dokter apa yang Anda ikuti?

1 ☐ Program reguler
2 ☐ Program internasional
3 ☐ Lainnya: .....
(mohon jelaskan)

### B3 Selama Anda kuliah, kira-kira berapa bulan waktu yang Anda habiskan untuk kegiatan di bawah ini?

| | Durasi (bulan) | |
|---|---|---|
| 1 | ☐☐ | Bekerja di bidang yang tidak berhubungan dengan dunia medis dan kesehatan |
| 2 | ☐☐ | Bekerja di bidang yang berhubungan dengan dunia medis dan kesehatan |
| 3 | ☐☐ | Magang, *internship* (sebagai bagian dari studi) |
| 4 | ☐☐ | Mengasuh anak dan urusan keluarga |
| 5 | ☐☐ | Menganggur, mencari kerja |
| 6 | ☐☐ | Lainnya: ..... |

(mohon jelaskan)

### B4 Selama masa studi Anda di FK-UGM, apakah Anda pernah tinggal di luar negeri (untuk keperluan bekerja atau belajar)?

1 ☐ Ya
2 ☐ Tidak → *Mohon dilanjutkan ke pertanyaan B6*

**B5 Jika YA, jelaskan di negara mana, lama tinggal dan untuk keperluan apa? (satu persatu bila lebih dari satu kali)**

| | A. Negara (mohon jelaskan) | B. Durasi *(bulan)* | C. Aktifitas utama *(jawaban boleh lebih dari satu)* |
|---|---|---|---|
| 1 | ..... | ☐☐ | ☐ Belajar (perkuliahan, studi independen, tesis, dll.)<br>☐ Bekerja / internship<br>☐ Lainnya (mohon jelaskan): ..... |
| 2 | ..... | ☐☐ | ☐ Belajar (perkuliahan, studi independen, tesis, dll.)<br>☐ Bekerja / internship<br>☐ Lainnya (mohon jelaskan): ..... |

**B6 Selama kuliah, apakah Anda aktif di organisasi (kemahasiswaan/sosial/kepemudaan/ agama, dll.)?**

1 ☐ Ya

2 ☐ Tidak → *Mohon dilanjutkan ke pertanyaan B8*

**B7 Seberapa aktifkah Anda di organisasi tersebut?**

| Sangat tidak aktif | | | | Sangat aktif |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| ☐ | ☐ | ☐ | ☐ | ☐ |

**B8 Selama kuliah, kira-kira berapa jam per minggu yang Anda gunakan untuk kegiatan di bawah ini? (A. Selama masa kuliah regular. B. Selama libur semester)**

| | Selama masa kuliah reguler (jam) | Selama libur semester (jam) | |
|---|---|---|---|
| 1 | ☐☐ | ☐☐ | Menghadiri perkuliahan |
| 2 | ☐☐ | ☐☐ | Aktifitas studi di luar kelas (kerja kelompok, persiapan, belajar, dll) |
| 3 | ☐☐ | ☐☐ | Persiapan test/ujian |
| 4 | ☐☐ | ☐☐ | Bekerja (tidak termasuk *internship*) |
| 5 | ☐☐ | ☐☐ | Urusan keluarga |
| 6 | ☐☐ | ☐☐ | Lainnya: ..... (mohon jelaskan) |

**B9 Berdasar pengalaman Anda semasa kuliah, bagaimanakah kondisi perkuliahan di FK-UGM?**

| | Sangat buruk 1 | 2 | 3 | 4 | Sangat baik 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Bimbingan akademik oleh dosen pembimbing akademik |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Bimbingan skripsi/tugas akhir |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Materi perkuliahan yang berhubungan dengan kedokteran |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Variasi mata kuliah yang ditawarkan |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Desain dari program studi |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Sistem penilaian |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk memilih mata kuliah dan area spesialisasi |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Penekanan unsur praktik dalam proses pembelajaran / belajar mengajar |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Kualitas pengajaran |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk berpartisipasi dalam proyek riset/penelitian |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Penekanan riset/penelitian dalam proses belajar mengajar |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Ketersediaan penempatan kerja dan kesempatan mendapatkan pengalaman kerja |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk berinteraksi dengan dosen di luar kelas |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Interaksi dengan mahasiswa lain di luar kelas |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk berpartisipasi dalam penentuan kebijakan di tingkat universitas |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Fasilitas dan koleksi perpustakaan |

bersambung…

lanjutan B9.

| | Sangat buruk 1 | 2 | 3 | 4 | Sangat baik 5 | |
|---|---|---|---|---|---|---|
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Ketersediaan materi perkuliahan |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Kualitas peralatan teknis (misal: PC, wlan, internet, dll) |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Kelengkapan laboratorium |
| 20 | ☐ | ☐ | ☐ | ☐ | ☐ | Ketersediaan konsultasi dengan ahli/pakar |
| 21 | ☐ | ☐ | ☐ | ☐ | ☐ | Lainnya: ..... (mohon jelaskan) |

## B10 Sejauh mana pengalaman kerja Anda selama kuliah (pekerjaan, internship, dll) berhubungan dengan bidang medis dan kesehatan

| Sama sekali tidak 1 | 2 | 3 | 4 | Sangat berhubungan 5 | Tidak sesuai, tidak ada pengalaman kerja |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

## B11 Bagaimana penilaian Anda terhadap hal-hal yang berhubungan dengan bimbingan dan konseling di FK-UGM?

| | Sangat buruk 1 | 2 | 3 | 4 | Sangat baik 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Staf pengajar memberikan saran yang berhubungan dengan profesi medis |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Staf pengajar mendiskusikan hasil ujian dan tugas-tugas tertulis |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Staf pengajar menyediakan konsultasi individu mengenai pekerjaan/okupasi bidang kedokteran |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Staf pengajar memberikan konsultasi individu seputar studi |

## B12 Apakah Anda mengalami kurikulum Problem-Based Learning (PBL) selama masa studi Anda?

1 ☐ Ya, seluruh masa studi

1 ☐ Ya, kurang lebih ☐☐ % dari masa studi

2 ☐ Tidak → *Mohon lanjutkan ke pertanyaan B14*

## B13 Secara umum seberapa puaskah Anda dengan penerapan kurikulum PBL?

| Sangat tidak puas 1 | 2 | 3 | 4 | Sangat puas 5 |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

## B14 Bagaimana kesesuaian antara kondisi di bawah ini dengan kondisi perkuliahan Anda?

| | | Sangat tidak sesuai 1 | 2 | 3 | 4 | Sangat sesuai 5 |
|---|---|---|---|---|---|---|
| | **Student-centred learning** | | | | | |
| 1 | Mahasiswa bertanggung jawab terhadap proses belajar mereka sendiri | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | Mahasiswa terlibat aktif dalam proses pembelajaran | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | Mahasiswa memiliki otonomi dalam proses pembelajaran | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | Dosen bukanlah sumber utama pengetahuan | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | Kesetaraan peran antara pengajar dan mahasiswa (interdependence) | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | Penekanan pada *deep-learning* | ☐ | ☐ | ☐ | ☐ | ☐ |
| | **Kelompok kecil** | | | | | |
| 1 | Proses pembelajaran berlangsung dalam kelompok kecil (5-9 mahasiswa) | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | Ukuran kelompok sudah sesuai untuk menstimulasi diskusi kelompok | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | Ada atmosfer yang positif dalam kelompok belajar (setiap anggota merasa nyaman) | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | Ukuran kelompok sudah sesuai untuk mendorong partisipasi aktif mahasiswa | ☐ | ☐ | ☐ | ☐ | ☐ |

bersambung…

lanjutan B14.

| | | Sangat tidak sesuai | | | | Sangat sesuai |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| | **Masalah sebagai stimulus proses belajar** | | | | | |
| | Masalah-masalah (skenario) dalam proses tutorial: | | | | | |
| 1 | …sesuai dengan tingkat pengetahuan mahasiswa | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | …menstimulasi proses berpikir, analisis dan *reasoning* | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | …menjamin terjadinya proses *self-directed learning* | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | …mengaktifkan pengetahuan yang sudah dimiliki mahasiswa sebelumnya (*prior-knowledge*) | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | …mengarahkan pada pencapaian tujuan pembelajaran | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | …membangkitkan keingintahuan mahasiswa | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7 | …menggunakan kosa kata yang tepat | ☐ | ☐ | ☐ | ☐ | ☐ |
| | **Masalah-masalah nyata** | | | | | |
| | Masalah-masalah dalam proses tutorial: | | | | | |
| 1 | …realistis | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | …relevan secara klinis | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | …berhubungan dengan topik kesehatan masyarakat | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | …menghasilkan bermacam hipotesis tentang penyebab dan solusinya | ☐ | ☐ | ☐ | ☐ | ☐ |
| | **Pengajar sebagai fasilitator** | | | | | |
| 1 | Tutor mamahami keunggulan/kelemahan-nya sebagai seorang tutor | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | Tutor termotivasi untuk menjalankan peran mereka sebagai tutor | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Tutor menstimulasi mahasiswa untuk: | | | | | |
| 3 | …merangkum apa yang telah mereka pelajari dalam kalimat mereka sendiri | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | …mencari hubungan antara isu-isu yang dibahas dalam proses tutorial | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | …memahami mekanisme dasar / teori | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | …menerapkan pengetahuan yg dimiliki dalam diskusi masalah | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7 | …menerapkan pengetahuan pada situasi / masalah lain | ☐ | ☐ | ☐ | ☐ | ☐ |
| 8 | …memberikan umpan balik yang konstruktif tentang kerja kelompok | ☐ | ☐ | ☐ | ☐ | ☐ |
| 9 | …mengevalusi kerjasama dalam kelompok secara berkala | ☐ | ☐ | ☐ | ☐ | ☐ |
| | **Self-directed learning** | | | | | |
| 1 | Mahasiswa berinisiatif untuk mendiagnosis kebutuhan belajar mereka | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | Mahasiswa memformulasikan tujuan belajar | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | Mahasiswa menentukan sendiri sumber yang digunakan dalam pembelajaran (baik manusia maupun materi) | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | Mahasiswa memilih strategi belajar yang tepat | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | Mahasiswa mengevaluasi akurasi dan nilai dari sumber pembelajaran | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | Mahasiswa memonitor sendiri kemajuan proses belajar mereka | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7 | Mahasiwa menilai sendiri hasil belajar mereka | ☐ | ☐ | ☐ | ☐ | ☐ |

## B15 Berapakah IPK sarjana Anda ketika lulus dari FK-UGM?

1 ☐,☐☐

## C. Aktifitas profesional dan pencarian kerja

Pertanyaan-pertanyaan di bawah ini berkaitan dengan aktifitas setelah lulus dari FK-UGM dengan gelar dokter (dr.).

**C1** **Apakah Anda pernah mencari pekerjaan sejak lulus?** *Jangan masukkan pekerjaan sambilan yang tidak berhubungan dengan studi*

1 ☐ Ya, di sektor medis dan kesehatan → *Lanjutkan ke pertanyaan C2*
2 ☐ Ya, di sektor selain medis dan kesehatan → *Lanjutkan ke pertanyaan C2*
3 ☐ Tidak, saya melanjutkan ke jenjang master → *Lanjutkan ke pertanyaan C7*
4 ☐ Tidak, saya meneruskan pekerjaan yang saya dapatkan sebelum saya lulus → *Lanjutkan ke pertanyaan C7*
5 ☐ Tidak, saya mendapatkan pekerjaan tanpa mencari → *Lanjutkan ke pertanyaan C6*
6 ☐ Tidak, saya berwirausaha → *Lanjutkan ke pertanyaan C7*
7 ☐ Lainnya: .....
(mohon jelaskan)

**C2** **Bagaimana cara Anda mencari pekerjaan setelah lulus?** *Jangan masukan pekerjaan sambilan yang tidak ada hubungannya dengan studi. Jawaban boleh lebih dari satu.*

1 ☐ 1. Lewat iklan media massa
2 ☐ 2. Saya menghubungi perusahaan/organisasi tanpa mengecek apakah ada lowongan
3 ☐ 3. Saya dihubungi oleh pemberi kerja
4 ☐ 4. Saya menghubungi agen ketenagakerjaan
5 ☐ 5. Saya menghubungi agen ketenagakerjaan komersial
6 ☐ 6. Saya mendapatkan bantuan di *career development center* universitas
7 ☐ 7. Saya mendapatkan bantuan dari staf pengajar
8 ☐ 8. Saya membangun jejaring/network semasa kuliah
9 ☐ 9. Dari rekan, relasi, orang-tua atau teman
10 ☐ 10. Saya membangun usaha sendiri
11 ☐ 11. Lainnya: .....
(mohon jelaskan)

**C3** **Dari metode di atas, mana yang paling efektif bagi Anda untuk mendapatkan pekerjaan? Tulislah nomor dari pilihan pertanyaan C2 di atas**

1 ☐☐ Adalah yang paling penting
2 ☐ Tidak sesuai, saya belum menemukan pekerjaan setelah lulus → *Lanjutkan ke pertanyaan C7*

**C4** **Berapa kantor/perusahaan/pemberi kerja lainnya yang Anda kontak (misal melalui surat) sebelum Anda mendapatkan pekerjaan pertama Anda.**

1 ☐☐☐

**C5** **Secara keseluruhan (sebelum dan/atau setelah lulus), kira-kira berapa bulankah waktu yang Anda habiskan untuk mendapatkan pekerjaan pertama Anda?**

Z9
1 ☐☐ Bulan
2 ☐ Tidak sesuai, saya belum menemukan pekerjaan

**C6** **Menurut Anda, seberapa pentingkah aspek-aspek di bawah ini menjadi pertimbangan pemberi kerja (*employer*) dalam merekrut Anda?**

| | Sangat tidak penting 1 | 2 | 3 | 4 | Sangat penting 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Program studi |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Spesialisasi |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | IPK |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Pengalaman praktik/kerja selama studi |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Reputasi universitas |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Pengalaman tinggal di luar negeri |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Penguasaan bahasa Inggris |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Penguasaan bahasa asing lain |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Keahlian menggunakan komputer |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Rekomendasi/referensi orang ketiga |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Kepribadian |

**C7** ***Apa saja aktivitas dominan Anda setelah lulus dari Fakultas kedokteran UGM? Jawaban boleh lebih dari satu.***

1 ☐ **Pendidikan profesi dokter (co ass)**

Tanggal mulai (bulan/tahun) ☐☐/☐☐☐☐

Tanggal selesai (bulan/tahun) ☐☐/☐☐☐☐

IPK: ☐,☐☐

☐ **Program magister (S2)**

Nama program: Institusi: ……..

Tanggal mulai (bulan/tahun) ☐☐/☐☐☐☐ ☐ Belum selesai

8 Tanggal selesai (bulan/tahun) ☐☐/☐☐☐☐

IPK: ☐,☐☐

☐ **Program doktor (S3)**

Nama program: Institusi: ……..

Tanggal mulai (bulan/tahun) ☐☐/☐☐☐☐ ☐ Belum selesai

Tanggal selesai (bulan/tahun) ☐☐/☐☐☐☐

☐ **Program spesialisasi**

Institution: ……

Tanggal mulai (bulan/tahun) ☐☐/☐☐☐☐ ☐ Belum selesai

Tanggal selesai (bulan/tahun) ☐☐/☐☐☐☐

Program spesialisasi apa yang Anda ikuti:

| | | |
|---|---|---|
| ☐ Kesehatan Anak | ☐ Kesehatan Mata | ☐ Bedah Anak |
| ☐ Bedah | ☐ Kedokteran Jiwa | ☐ Bedah Orthopedi |
| ☐ Penyakit dalam | ☐ Radiologi | ☐ Urologi |
| ☐ Obstetri dan Genekologi | ☐ Penyakit Saraf | ☐ Penyakit Jantung dan Pembuluh Darah |
| ☐ Anestesiologi dan Reanimasi | ☐ Penyakit THT dan Bedah Kepala Leher | ☐ Lainnya:……. |
| ☐ Forensik dan Mediko legal | ☐ Patologi Anatomi | ..... |
| ☐ Kesehatan kulit dan kelamin | ☐ Patologi Klinik | (mohon jelaskan) |

☐ **Cuti melahirkan atau cuti karena urusan keluarga**

Selama kurang lebih: ☐ Tahun, ☐☐ Bulan

☐ **Bekerja / berwirausaha**

Selama kurang lebih: ☐ Tahun, ☐☐ Bulan

☐ **Tidak bekerja**

Selama kurang lebih: ☐ Tahun, ☐☐ Bulan

☐ **Lainnya**: ..... Selama kurang lebih: ☐ Tahun, ☐☐ Bulan

(mohon jelaskan)

## D. Aktifitas saat ini dan pekerjaan

*Pertanyaan-pertanyaan di bawah ini berhubungan dengan aktifitas pekerjaan Anda saat ini. Termasuk training pekerjaan yang berbayar seperti internship. Tidak termasuk pekerjaan temporer yang tidak berhubungan dengan studi.*

**D1 Apakah Anda saat ini bekerja/berwirausaha?**

1 ☐ Ya, saya bekerja
2 ☐ Ya, saya berwirausaha. → Lanjutkan ke pertanyaan D4
3 ☐ Tidak. Lanjutkan ke pertanyaan D13

**D2 Status pekerjaan saat ini?**

1 ☐ Permanen
2 ☐ Temporer
3 ☐ Lainnya: .....
(mohon jelaskan)

**D3 Dalam kontrak kerja, berapa jam Anda harus bekerja dalam 1 minggu?**

1 ☐☐

**D4 Pada kenyataannya, berapa jam Anda bekerja dalam 1 minggu?**

1 ☐☐

**D5 Deskripsikan situasi pekerjaan Anda saat ini. Jawaban boleh lebih dari satu.**

1 ☐ Saya mempunyai pekerjaan tetap
2 ☐ Saya berwirausaha
3 ☐ Saya mempunyai pekerjaan tidak tetap yang berhubungan dengan bidang medis dan kesehatan
4 ☐ Saya mempunyai pekerjaan tidak tetap yang TIDAK berhubungan dengan bidang medis dan kesehatan
5 ☐ Saya mempunyai lebih dari satu pekerjaan
6 ☐ Lainnya: .....
(mohon jelaskan)

***Jika Anda memiliki lebih dari satu pekerjaan, jawablah pertanyaan di bawah ini berdasarkan pekerjaan utama Anda.***

**D6 Kapan Anda mulai bekerja di pekerjaan saat ini?**

1 Bulan: ☐☐ Tahun: ☐☐☐☐

**D7 Jelaskan jenis kantor/perusahaan dimana Anda bekerja sekarang**

1 ☐ Kantor pemerintah atau BUMN
2 ☐ Organisasi nirlaba
3 ☐ Perusahaan swasta
4 ☐ Memiliki usaha sendiri
5 ☐ Lainnya: .....
(mohon jelaskan)

**D8 Jelaskan lingkungan tempat Anda bekerja saat ini?**

1 ☐ Praktek medis
2 ☐ Universitas/perguruan tinggi
3 ☐ Rumah sakit pendidikan
4 ☐ Rumah sakit daerah
5 ☐ Rumah sakit internasional
6 ☐ Praktek di kantor/perusahaan swasta (misal: dokter perusahaan)
7 ☐ Organisasi riset
8 ☐ Lingkungan medis dan kesehatan lainnya: .....
(mohon jelaskan)
9 ☐ Lingkungan non-medis dan kesehatan lainnya: .....
(mohon jelaskan)

**D9 Apa posisi kerja Anda saat ini?** *Jika memungkinkan sertakan deskripsi pekerjaan secara jelas. (misal: dokter PTT, tenaga medis di RS, pekerja sosial, dll )*

.....

.....

.....

**D10 Apakah tugas utama Anda dalam pekerjaan saat ini?** *Sertakan deskripsi secara jelas (misal: menyediakan pelayanan medis di daerah tertinggal, mengajar, melakukan penelitian, dll)*

.....

.....

.....

**D11 Berapa kira-kira penghasilan Anda perbulan ?**

| | | Juta rupiah |
|---|---|---|
| 1 | Dari pekerjaan utama (termasuk lembur dan bonus) | ☐☐,☐☐ |
| 2 | Dari pekerjaan lainnya | ☐☐,☐☐ |

**D12 Dimana lokasi Anda bekerja / berwirausaha saat ini?**

1 ☐ Indonesia

Kota: .....

Propinsi: .....

2 ☐ Luar negeri: ..... (mohon jelaskan)

**D13 Sudah berapa kali Anda pindah kerja sejak lulus?** *(termasuk mendirikan usaha sendiri)*

1 ☐☐ kali

2 ☐ tidak sesuai, saya belum pernah bekerja setelah lulus

**D14 Setelah lulus dari FK UGM apakah Anda pernah melakukan hal-hal dibawah ini? (Jawaban boleh lebih dari satu)**

1 ☐ Mempertimbangkan untuk bekerja di luar negeri

2 ☐ Mencari pekerjaan di luar negeri

3 ☐ Mendapatkan tawaran bekerja di luar negeri

4 ☐ Bekerja di luar negeri

5 ☐ Dikirim keluar negeri oleh kantor untuk tugas kerja

6 ☐ tidak pernah → Lanjutkan ke pertanyaan D16

**D15 Jika Anda pernah bekerja di luar negeri, di negara mana dan berapa lama?**

| | A. Durasi *(bulan)* | B. Negara (mohon jelaskan) |
|---|---|---|
| 1 | ☐☐ | ..... |
| 2 | ☐☐ | ..... |

**D16 Seberapa sering anda membaca jurnal profesional/ilmiah bidang kesehatan/medis selama 12 bulan terakhir?**

| | Tidak pernah | Jarang | Kira-kira 3 bulan sekali | Setiap bulan | Paling tidak sekali seminggu | Setiap hari |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**D17 Seberapa sering Anda mengikuti konferensi/pertemuan terkait bidang kesehatan/medis selama 12 bulan terakhir?**

| | Tidak pernah | 1 sampai 3 kali | 4 kali atau lebih |
|---|---|---|---|
| | 1 | 2 | 3 |
| 1 | ☐ | ☐ | ☐ |

**D18 Seberapa sering Anda menggunakan internet untuk mencari informasi kesehatan/medis selama 12 bulan terakhir?**

| | Tidak pernah | Jarang | Kira-kira 3 bulan sekali | Sebulan sekali | Paling tidak seminggu sekali | Setiap hari |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

# E. Kompetensi

## E1 Bagaimana tingkat kompetensi Anda pada saat lulus dari FK UGM?

| | Sangat rendah 1 | 2 | 3 | 4 | Sangat tinggi 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Pengetahuan umum |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan berpikir/pengetahuan lintas ilmu |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Pengetahuan teoritis ilmu kedokteran |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Pengetahuan tentang metode-metode medis |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Pemahaman akan sistem yang berlaku di masyarakat/organisasi/kelompok |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Perencanaan, koordinasi dan organisasi |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Mematuhi peraturan dan perundangan |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Penalaran ekonomi |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Mendokumentasikan ide dan informasi |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan penyelesaian masalah |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan menganalisis |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Berpikir reflektif, mengevaluasi hasil kerja sendiri |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Kreativitas |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Bekerja dibawah tekanan |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Akurasi dan perhatian terhadap hal-hal rinci |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Manajemen waktu |
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Negosiasi |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Bekerja mandiri |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Bekerja dalam tim |
| 20 | ☐ | ☐ | ☐ | ☐ | ☐ | Inisiatif |
| 21 | ☐ | ☐ | ☐ | ☐ | ☐ | Adaptasi |
| 22 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan berkonsentrasi |
| 23 | ☐ | ☐ | ☐ | ☐ | ☐ | Loyalitas, integritas |
| 24 | ☐ | ☐ | ☐ | ☐ | ☐ | Berpikir kritis |
| 25 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan komunikasi secara lisan |
| 26 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan komunikasi secara tertulis |
| 27 | ☐ | ☐ | ☐ | ☐ | ☐ | Toleransi, menghargai perbedaan pendapat |
| 28 | ☐ | ☐ | ☐ | ☐ | ☐ | Kepemimpinan |
| 29 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan mengambil keputusan/tanggung jawab |
| 30 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan berkolaborasi |
| 31 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan *self-directed learning* |
| 32 | ☐ | ☐ | ☐ | ☐ | ☐ | Beradaptasi dengan ketidakpastian |

*Jika Anda saat ini tidak bekerja lanjutkan ke pertanyaan G1*

## E2 Bagaimana tingkat kompetensi Anda pada saat ini?

| | Sangat rendah 1 | 2 | 3 | 4 | Sangat tinggi 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Pengetahuan umum |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan berpikir/pengetahuan lintas ilmu |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Pengetahuan teoritis ilmu kedokteran |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Pengetahuan tentang metode-metode medis |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Pemahaman akan sistem yang berlaku di masyarakat/orgnisasi/kelompok |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Perencanaan, koordinasi dan organisasi |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Mematuhi peraturan dan perundangan |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Penalaran ekonomi |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Mendokumentasikan ide dan informasi |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan penyelesaian masalah |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan menganalisis |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Berpikir reflektif, mengevaluasi hasil kerja sendiri |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Kreativitas |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Bekerja dibawah tekanan |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Akurasi dan perhatian terhadap hal-hal rinci |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Manajemen waktu |
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Negosiasi |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Bekerja mandiri |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Bekerja dalam tim |
| 20 | ☐ | ☐ | ☐ | ☐ | ☐ | Inisiatif |
| 21 | ☐ | ☐ | ☐ | ☐ | ☐ | Adaptasi |
| 22 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemempuan berkonsentrasi |
| 23 | ☐ | ☐ | ☐ | ☐ | ☐ | Loyalitas, integritas |
| 24 | ☐ | ☐ | ☐ | ☐ | ☐ | Berpikir kritis |
| 25 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan komunikasi secara lisan |
| 26 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan komunikasi secara tertulis |
| 27 | ☐ | ☐ | ☐ | ☐ | ☐ | Toleransi, menghargai perbedaan pendapat |
| 28 | ☐ | ☐ | ☐ | ☐ | ☐ | Kepemimpinan |
| 29 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan mengambil keputusan/tanggung jawab |
| 30 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan berkolaborasi |
| 31 | ☐ | ☐ | ☐ | ☐ | ☐ | Kemampuan *self-directed learning* |
| 32 | ☐ | ☐ | ☐ | ☐ | ☐ | Beradaptasi dengan ketidakpastian |

# F. Pendidikan tinggi dan dunia kerja

## F1 Melihat pekerjaan/tugas-tugas Anda secara keseluruhan, sejauh mana Anda menggunakan pengetahuan dan keterampilan yang Anda dapatkan sewaktu kuliah?

| | Sangat sedikit 1 | 2 | 3 | 4 | Sangat banyak 5 |
|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ |

**F2 Tingkat pendidikan akademik apa yang paling cocok untuk pekerjaan/tugas-tugas Anda saat ini?**

1 ☐ Lebih tinggi dari pendidikan profesi dokter
2 ☐ Setingkat dengan pendidikan profesi dokter
3 ☐ Setingkat dengan sarjana kedokteran
4 ☐ Lebih rendah dari sarjana kedokteran
5 ☐ Lainnya: .....
(mohon jelaskan)

**F3 Sejauh mana pekerjaan Anda pada saat ini memenuhi harapan-harapan Anda sewaktu kuliah dulu?**

| | Lebih buruk dari harapan | | | | Lebih baik dari harapan | Saya tidak memiliki harapan apa-apa |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

# G Orientasi pekerjaan dan kepuasan kerja

**G1 Seberapa pentingkah karakteristik pekerjaan di bawah ini menurut Anda pribadi?**

| | Sangat tidak penting | | | | Sangat penting | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Bekerja mandiri |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk mengerjakan tugas-tugas ilmiah/akademik |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Tanggung jawab kerja yang jelas dan teratur |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk menerapkan kompetensi yang didapatkan sewaktu kuliah |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Keamanan finansial |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Status sosial dan pengakuan masyarakat |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk merealisasikan ide-ide pribadi |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Iklim sosial yang baik |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk belajar yang berkelanjutan |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Penghasilan yang besar |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk memiliki pengaruh (politik) di masyarakat |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Tugas-tugas yang menantang |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Prospek karir yang baik |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Waktu luang yang cukup |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Tugas-tugas managerial dan koordinasi |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan bekerja dalam tim |
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan melakukan sesuatu yang berguna bagi masyarakat |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Tugas yang bervariasi |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Pembagian waktu yang seimbang antara pekerjaan dan keluarga |

*Jika Anda saat ini tidak bekerja lanjutkan ke pertanyaan H1*

## G2 Seberapa sesuaikah karakteristik pekerjaan di bawah dengan kondisi pekerjaan saat ini?

| | Sangat tidak sesuai 1 | 2 | 3 | 4 | Sangat sesuai 5 | |
|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ | Bekerja mandiri |
| 2 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk mengerjakan tugas-tugas ilmiah/akademik |
| 3 | ☐ | ☐ | ☐ | ☐ | ☐ | Tanggung jawab kerja yang jelas dan teratur |
| 4 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk menerapkan kompetensi yang didapatkan sewaktu kuliah |
| 5 | ☐ | ☐ | ☐ | ☐ | ☐ | Keamanan finansial |
| 6 | ☐ | ☐ | ☐ | ☐ | ☐ | Status sosial dan pengakuan masyaraka |
| 7 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk merealisasikan ide-ide pribadi |
| 8 | ☐ | ☐ | ☐ | ☐ | ☐ | Iklim sosial yang baik |
| 9 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk belajar yang berkelanjutan |
| 10 | ☐ | ☐ | ☐ | ☐ | ☐ | Penghasilan yang besar |
| 11 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan untuk memiliki pengaruh (politik) di masyarakat |
| 12 | ☐ | ☐ | ☐ | ☐ | ☐ | Tugas-tugas yang menantang |
| 13 | ☐ | ☐ | ☐ | ☐ | ☐ | Prospek karir yang baik |
| 14 | ☐ | ☐ | ☐ | ☐ | ☐ | Waktu luang yang cukup |
| 15 | ☐ | ☐ | ☐ | ☐ | ☐ | Tugas-tugas managerial dan koordinasi |
| 16 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan bekerja dalam tim |
| 17 | ☐ | ☐ | ☐ | ☐ | ☐ | Kesempatan melakukan sesuatu yang berguna bagi masyarakat |
| 18 | ☐ | ☐ | ☐ | ☐ | ☐ | Tugas yang bervariasi |
| 19 | ☐ | ☐ | ☐ | ☐ | ☐ | Pembagian waktu yang seimbang antara pekerjaan dan keluarga |

## G3 Secara keseluruhan, seberapa puas Anda terhadap pekerjaan Anda saat ini?

| | Sangat tidak puas 1 | 2 | 3 | 4 | Sangat puas 5 |
|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☐ | ☐ |

# H. Data sosio-biografi

## H1 Jenis kelamin

1 ☐ Perempuan

2 ☐ Laki-laki

## H2 Tahun lahir

1 19☐☐

## H3 Di mana saat ini Anda tinggal?

1 ☐ Indonesia

Kota: .....

Propinsi: .....

2 ☐ Luar negeri: .....

(mohon jelaskan)

## H4 Status perkawinan:

1 ☐ Belum menikah

2 ☐ Menikah

3 ☐ Berpisah/cerai

## H5 Pendidikan tertinggi orang tua:

| | Father | Mother | Spouse | |
|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | Sekolah dasar |
| 2 | ☐ | ☐ | ☐ | Sekolah menengah pertama |
| 3 | ☐ | ☐ | ☐ | Sekolah menengah umum |
| 4 | ☐ | ☐ | ☐ | Diploma |
| 5 | ☐ | ☐ | ☐ | Sarjana |
| 6 | ☐ | ☐ | ☐ | Program profesional |
| 7 | ☐ | ☐ | ☐ | Master |
| 8 | ☐ | ☐ | ☐ | Doctor |

## H6 Profesi orang tua

Ayah:.....

Ibu:.....

## H7 Apakah ada anak-anak dalam rumah tangga Anda?

1 ☐ Ya → Berapa banyak? ☐☐ Anak

2 ☐ Tidak

## H8 Apakah aktifitas utama pasangan Anda saat ini

1 ☐ Tidak sesuai, saya belum berkeluarga

2 ☐ Bekerja

3 ☐ Berwirausaha

4 ☐ Tidak bekerja, sedang mencari pekerjaan

5 ☐ Mengikuti training/pelatihan profesional

6 ☐ Melanjutkan studi

7 ☐ Mengurusi keluarga

8 ☐ Lainnya: .....

(mohon jelaskan)

# I. Kontak dengan FK UGM

**I1 Kontak semacam apa yang sudah/ingin Anda dapatkan dari fakultas/universitas?** *Jawaban bisa lebih dari satu*

| | Sudah ada | Perlu diadakan | |
|---|---|---|---|
| 1 | ☐ | ☐ | Newsletter atau informasi semacamnya dari FK UGM |
| 2 | ☐ | ☐ | Newsletter atau informasi semacamnya dari UGM |
| 3 | ☐ | ☐ | Undangan acara-acara di UGM |
| 4 | ☐ | ☐ | Undangan untuk melakukan presentasi di FK UGM |
| 5 | ☐ | ☐ | Kontak professional/ilmiah dengan UGM |
| 6 | ☐ | ☐ | Partisipasi dalam jejaring alumni UGM |
| 7 | ☐ | ☐ | Informasi tentang studi lanjut di UGM |
| 8 | ☐ | ☐ | Kontak dengan staf pengajar |
| 9 | ☐ | ☐ | Kontak dengan alumni lainnya |
| 10 | ☐ | ☐ | Lainnya: ..... (mohon jelaskan) |

# J. Komentar dan saran

**J1 Masukan untuk perbaikan FK UGM**

.....

.....

.....

**J2 . Komentar lainnya (misal: mengenai kuesioner ini)**

.....

.....

.....

***Terima kasih atas partisipasi Anda***