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Developing an instrument to measure student's perception of the medical education curriculum from the perspective of Communities of Practice theory

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Abstract

The concept of participation as a learning process is essential to foster professional identity development. Faculties are expected to provide a curriculum that supports students' participation in the profession's context. Curriculum evaluation is needed to assess the extent to which curriculum implementation supports participation. In this regard, this study aims to develop instruments that measure students' perceptions of the medical education curriculum. The blueprint for the instrument's development was based on the concept of participation in communities of practice theory. Qualitative research, which involved 17 pre-clinical and clinical medical students as participants, was conducted to explore medical students' perception about formal learning activities that encourage participation. The results were used to generate the items. A series of review processes, item reduction, revisions, and analysis generated 20 items in four factors, namely: engagement support, imagination support, convergence, and feedback. This shows that the instrument is multidimensional. The instrument also has good discriminant validity and composite reliability.

Keywords: *curriculum in action, communities of practice, participation, medical education*

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Introduction

The environment in education shapes the student's learning process (Genn, 2001a). Learning can be seen in several concepts. The learning concept that underlies curriculum development will affect the learning environment that is formed. There are two learning metaphors, namely learning as an acquisition process, and also learning as a participation process (Bleakley, Bligh, & Browne, 2011; Mann, 2011). In the current medical education, there is an increase in the attention to the formation of professional identity with participation as the learning process. Socio-cultural learning theory is considered to be fundamental in this condition (Bleakley, 2006; Mann, 2011). One of the sociocultural learning theories is situated learning theory (Lave & Wenger, 1991).

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Communities of practice (which is also known as CoP) (Wenger, 1998) that evolved from the Situated Learning Theory (Lave &

Wenger, 1991) sees the learning process as one's participation process in entering communities of practice. This theory rejects learning as merely an acquisition process. Thus, in this theory, the learning process is bound by the situation or context. In this way, the curriculum for the learning process is seen as chances that are provided by the educational program for students to participate.

Undergraduate students who start medical education can be seen as someone who starts to learn to become a member of the medical profession. They develop their identity as a physician. The professional identity formation is important for a future physician because it will influence their practice later as a physician (Forsythe, 2005). Participation is the source of professional identity formation (Wenger, 1998). Participation is a complex process of an individual that involves physical, emotions, and feelings in both individual or group activities, such as the sense of belonging, thinking, speaking, and engagement in activities related to their part in a community.

There are three forms of participation, namely engagement, imagination, and alignment. These three are not separated concepts but related to each other. Engagement is the main participation form in practice. Engagement can appear as actions that are carried out either individually or in a group, for example, group discussion, being involved in professional activities, or, using and making an artifact in the professional community (Wenger, 2009). Imagination is a form of participation that aims to build perspective about self, about community, and about the outside world to conduct self-orientation, situation reflection, and possibility exploration. Alignment is a process of choosing and developing commitment. Alignment determines the participation conducted according to concepts or principles of the community and can ensure that the local activities are also aligned with other processes that are globally accepted.

Participation, as a part of learning process, should be supported by the faculty by implementing curriculums that do not emphasize on the teaching process. Faculties need to encourage the students' opportunity in order to engage, imagine, and explore themselves as well as the community. Evaluation of the curriculum in action was needed to ensure it. The curriculum in action is a way a curriculum is implemented in practice or reality (Fish & Colles, 2005). For measuring the curriculum implementation in providing this learning and participation facilities, a measurement instrument is needed.

This instrument can be utilized to evaluate the educational process that supports participation. The perception from medical students is very essential for the evaluation because based on this theory, learners are the only one who experiences proper resources for themselves to be able to learn or participate in a professional community.

Method

Instrument development is conducted through several steps. The first step was determining the aim of the instrument and developing the blueprint. Instrument development aims to enable measurement of perceptions of participation support in the medical education curriculum in action. The instrument measure students' perception of the curriculum they receive in terms of their opportunities to engage, imagine, and also to know their alignment in the medical education context. Instrument development steps are presented in Figure 1. Ethical approval for the present study was obtained from the Ethical Committee, Faculty of Medicine, UGM. This research has received permission from the Faculty of Medicine, Universitas Gadjah Mada (UGM) and Faculty of Medicine, Universitas Mataram.

Qualitative research was done to explore students' perceptions regarding the curriculum in action. These study results are utilized for instrument items. The qualitative exploration involved 17 pre-clinical and clinical medical students as participants.

Sampling took into consideration education year, GPA, sex, and their activeness in an organization. Data collection was conducted through semi-structured interviews. Aspects explored included support towards engagement, such as opportunities to interact with the medical professional community, op-

portunities to discuss medical problems, opportunities to practice clinical skills. Support to imagination included a clear explanation of medical profession roles, clinical explanation contextual level, clear medical professional overview, and opportunity to reflect students' experience. Alignment support included the curriculum's ability in ensuring students about their capability during education according to medical profession roles and competencies, including material relevance with medical practice, assessment system clearness, and feedback in students' competencies improvement. Qualitative analysis was conducted by coding interview transcripts. Coding procedure with peer coder (using independent second coder) and member checking procedure was conducted to improve the reliability of the qualitative analysis. The codes were classified into subthemes and themes.

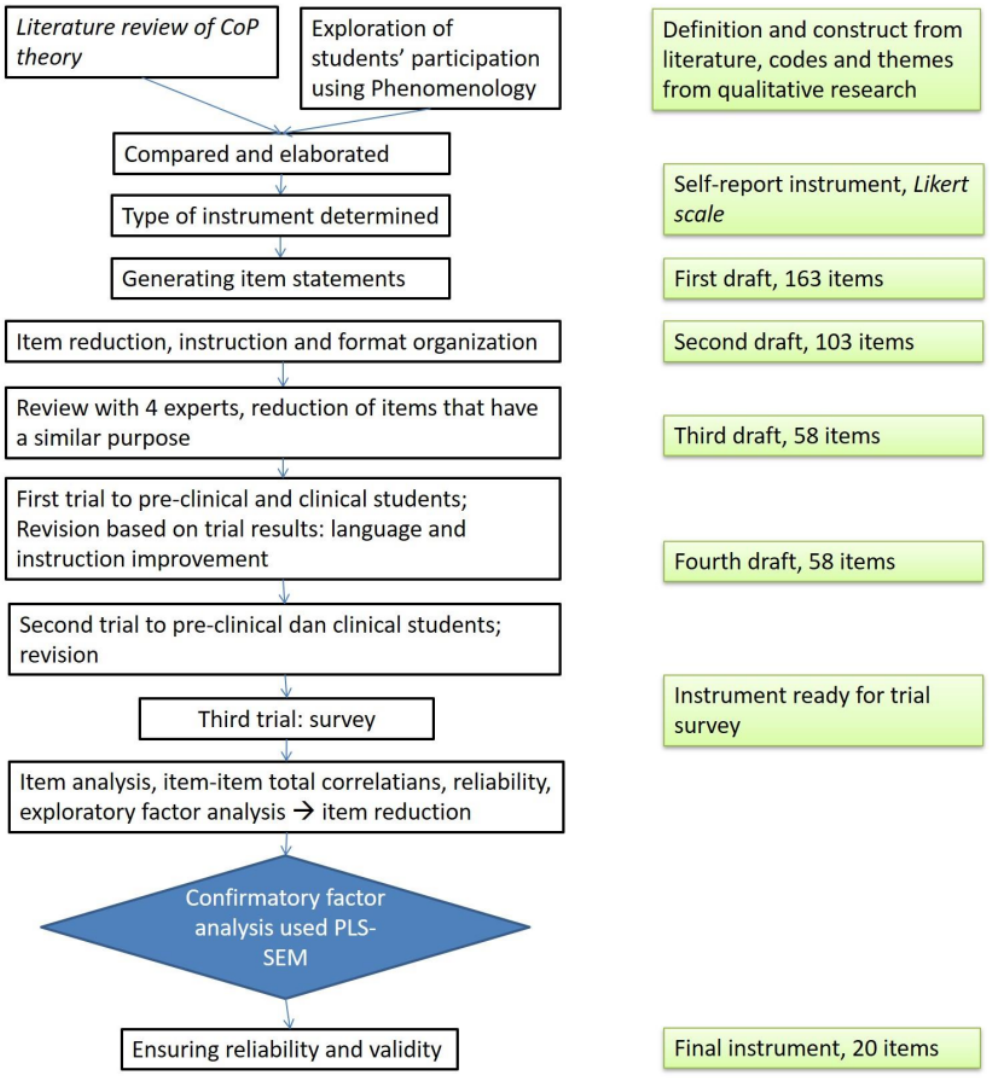

Figure 1. The Instrument Development Process

The results of this qualitative study and literature review were elaborated to produce instrument items. Codes were converted into sentences used as instrument items. Sentences were aligned to measurement formats and dimensions within the instrument. This process resulted in 163 statement items. These items were reduced, redundant statements were removed, leaving in a total of 103 items.

The instrument used is a self-report instrument with a Likert scale 1-5 (1 is strongly disagree, 5 is strongly agree). The next step is developing guidelines for the subject and layouting the instrument. The guidelines cover measurement purposes, measured aspects, data confidentiality, and filling instruction.

Review with experts reduced overlapping items resulting in 58 items left. Improvement was regularly conducted including revised ambiguous sentences and sentences inappropriate with the expected measurement (i.e., statement that should be answered with highly disagree-highly agree but appeared to measure frequency or a yes-no question).

In the next step, the instrument was tested to several students to measure its readability. This step is useful to strengthen face validation by discovering any misinterpretation of statements within the instrument. The first test was conducted to five pre-clinical medical students and eight clinical students. The feedbacks were obtained from individual written comments and of the focused group discussion. Beside trying to confirm students' interpretation as a user with expected interpretation, the test aims to provide information on the duration of instrument filling, instrument length, instrument layout for comfort, and ease in the filling process. The second test was done to students, divided into two phases. The first one was tested on seven pre-clinical students and the second was on three pre-clinical and four clinical students. After each test, the instrument was revised considering students' feedbacks.

The results of these revisions were used for survey as pilot testing. Survey was done to medical undergraduates and interns from the faculty of medicine Universitas Mataram. Out of 347 students, 303 filled the questionnaire. The survey results underwent a factor analysis to obtain construct validity and reliability. The reliability limit is relative but as high as possible (Azwar, 2004). Factor analysis was done with partial least square-structural equation model (PLS-SEM). PLS-SEM can be applied in a research project with limited participants and skewed distribution data (Wong, 2013). In this research, construct convergent validity is shown by AVE value > 0.5. Beside good convergent validity, the instrument also needs to have good discriminant validity. Discriminant validity indicates the items measuring a construct have a low correlation with other constructs. In this case, discriminant validity is shown by higher construct AVE square root compared to correlation value to other constructs. Reliability can be seen from the composite reliability value > 0.7.

Findings and Discussion

Qualitative research resulted in codes classified into eight categories. These eight categories are aspects to take into a concern to support participation according to Wenger (1998). These are mutuality, competence, continuity, all three support engagement; orientation, reflection, exploration, all three support imagination; convergence, jurisdiction, and also coordination, and all three support alignment. A total of 58 items in eight categories was tested through the survey.

Mutuality is the availability of adequate group activities with peer students, lecturers, physicians, other professions, or patients. In this concept, the more group activities there are, the easier students interact and learn. Competence is an opportunity for students to show their competencies. Continuity covers opportunity that allows values, principles, and information on medical professional community delivery from fulltime members to the new member. Imagination support includes opportunity in the curriculum to provide an overview of the medical profession, reflect on experiences in the community, and explore self capabilities and possibilities in the community. Alignment support includes activity convergences in the curriculum to achieve the learning process in preparing students to enter the professional community. Jurisdiction is feedback facilities for students to improve

their competencies. Coordination is facilitating students to coordinate with the faculty in curriculum improvement.

Exploratory factor analysis (EFA) was done to obtain the items' clustering tendency. From EFA KMO value (Kaiser-Meyer-Olkin) met the condition >0.5, i.e. 0.796, and significant Bartlett's test value <0.05, i.e. 0.001. The result shows the variables and samples used can be analyzed further. Next, the measure of sampling adequacy (MSA) value of all items shows >0.5 that means variables can be predicted and analyzed further. The items were extracted in eight factors (based on the categorization from qualitative study). From the component matrix, items with loading factor low (.5) were taken out from the next analysis step. The remaining items then were confirmed with confirmatory factor analysis (CFA) by PLS-SEM. Model 1 involved 34 items grouped in eight factors: five mutuality items, three actualization opportunity (competency) items, six orientation items, three reflection facility items, four exploratory items, eight convergency items, two jurisdiction items, three coordination items, and two opportunities with patients items. Items with loading factor <.7 were taken out from the analysis, so 23 items in eight factors were left, named as shown in Table 1.

The second-order CFA shows that the eight factors are the constructs of the curriculum in action. VIF value is < 3.3, so no colinearity problem is present in the model 2 instrument. The collinearity problem indicates the items are redundant. Model 2 curriculum in action instrument has good reliability, with composite reliability coefficient >.7. The convergent validity with AVE of all constructs or curriculum in action constructs element factor >.5. The discriminant validity is very good with all constructs or factors AVE square root higher than the inter construct correlation coefficient. The construct validity and reliability are shown in Table 2. The instrument was then analyzed in third-order CFA. Mutuality, opportunity to interact with patients, and opportunity for self-actualization constructs became a construct namely engagement support; orientation and reflection facility constructs became imagination support construct. The coordination construct has the lowest loading factor and indicator weight in the curriculum. Thus, in model 3, the coordination construct was not included in construct elements of the curriculum in action.

Table 1. Constructs in Measurement Instrument Model 2

Constructs Resulted from Factor Analysis Results and Definition	Statement Examples	No of Items
Mutuality: measures the availability of opportunities that allow practice sharing with peers and lecturers	The learning sessions facilitate me to share knowledge with my colleagues.	4
Actualization opportunity: measures the availability of opportunity to show competency	The curriculum provides me an adequate opportunity to apply my clinical skill towards the patient/simulated patient.	2
Opportunity to encounter patients: Measures the availability of opportunity for students to face real-life patients	The curriculum provides me an adequate opportunity to interact with real patients	2
Orientation: measures the availability of opportunities for students to obtain orientation on medical practice	The curriculum provides me an adequate opportunity to directly observe a clinical practice.	4
Facility for reflection: measures support to students for reflection	When I encounter a disconnection between ideal medical practice with reality, the faculty help me to analyze it	2
Convergence: measures learning process suitability in the formation of knowledge and medical mindset	The curriculum helps ease me to apply the knowledge and skill according to patients' problems	4
Feedback facility: measures curriculum in action to facilitate the availability of feedback on students' competencies	The curriculum facilitates students to gain feedback from peers, nurses, patients, or residents	2
Coordination: measures curriculum in action in facilitating students' coordination with faculty in curriculum improvement	Students can provide feedback to the faculty for learning process improvement	3

Table 2. Reliability and construct validity of subdimension

	1	2	3	4	5	6	7	8
Reliability								
Composite reliability	0.843	0.864	0.833	0.847	0.891	0.784	0.719	0.911
Crönbach Alpha	0.752	0.686	0.733	0.759	0.816	0.449	0.219	0.804
Convergence validity								
AVE	0.573	0.761	0.556	0.580	0.731	0.645	0.562	0.836
*Discriminant validity**								
Convergence	0.757	0.166	0.347	0.256	0.243	0.242	0.285	0.190
Feedback	0.166	0.855	0.111	0.081	0.295	0.227	0.211	0.164
Mutuality	0.347	0.111	0.746	0.266	0.225	0.095	0.331	0.190
Orientation	0.256	0.081	0.266	0.762	0.332	0.212	0.409	0.464
Coordination	0.243	0.295	0.225	0.332	0.872	0.252	0.345	0.395
Facilities Reflect	0.242	0.227	0.095	0.212	0.252	0.803	0.202	0.142
Actualization	0.285	0.211	0.331	0.409	0.345	0.202	0.749	0.478
Interact with Patient	0.190	0.164	0.190	0.464	0.395	0.142	0.478	0.681

1=convergence; 2=feedback; 3=mutuality; 4=orientation; 5=coordination; 6=facility for reflection; 7=opportunity for actualization; 8=opportunity to interact with patients.
*Good discriminant validity showed by all constructs AVE square root (shadowed in diagonal) higher than inter construct correlation coefficient (unshadowed)

Table 3. Reliability and Convergence Validity of Four Dimensions in the Instrument

	Engagement	Imagination	Convergence	Feedback	Instrument
Composites reliability	0.790	0.755	0.843	0.864	0.815
Crönbach Alpha	0.600	0.350	0.752	0.686	0.697
AVE	0.560	0.606	0.573	0.761	0.526

The reliability of model 3 instrument is good, with the composite reliability coefficient >.7. Convergent validity is good, with all construct AVE or constructs element factor of curriculum action >.5 (Table 3). These four factors are proven to be curriculum in action construct elements (indicator weight < .001).

Instrument development is inseparable from validity and reliability issues. Validity depicts the conformity of items measured by the instrument with measurement purposes. Validity is a continuum, meaning that the more proof showing the instrument is valid, the bigger the opportunity to obtain suitable or needed information. Validity also shows degree, not only valid or invalid but will be better if classified as high validity or low validity (Colton & Covert, 2007). Validity is also conceptualized in several ways. In this instrument development, the validation process resulted in information on content validity, face validity, and construct validity that also portrays convergence validity and discriminant validity.

Content validity is a degree that the instrument represents topics or processes that should be measured. In this instrument development, content validity is strengthened with literature review especially regarding the participation concept and the way environment supports participation according to literature. This step helped instrument development in terms of purpose development and limiting construct definition within the instrument. The literature review results became the foundation for instrument blueprint development. Content validity was also supported by expert reviews. In this case, experts provided inputs especially in terms of content and language. Face validity was strengthened by requesting inputs from students through repeated qualitative tests until the instrument was easily understood.

The step of quantitative factor analysis of test results with surveys is a step to obtain information on instrument construct validity. In this study, an EFA technique was utilized first to get a picture regarding the tendency of items to cluster and construct suitability in the instrument. CFA was used next to reconfirm the conformity of items and constructs. In this study, the analysis must be done gradually to obtain items that can explain construct >

70% (loading factor >0.7), significant indicator weight, good convergence validity, discriminant validity, and no collinearity issues. Colinearity issues occur when there are redundant items or are measuring similar things. Convergence validity indicates that items in one construct relate to each other.

Model 1 analysis still resulted in items with loading factors < 0.70, therefore model 2 analysis was needed. Model 2 analysis has provided good construct validity and reliability, but the convergence validity of the instrument was not good enough. Third-order CFA was done to simplify constructs and remove constructs that had the lowest indicator weight, i.e. coordination construct. From the analysis, an instrument consisting of 20 items in four factors was obtained (Table 4). This instrument then is called the Pasport CiAME (Participation Support in Curriculum in Action of Medical Education) instrument.

Students' perception of the educational environment defines their behavior in the learning process (Genn, 2001a). The formal curriculum is an element in the educational environment. Implementation of the formal curriculum called curriculum in action, a curriculum received and perceived by the students. Many instruments for the measurement of educational climate has been developed (Genn, 2001b). Besides, Soemantri, Herrera, and Riquelme (2010) have identified 31 instruments for measuring educational climate in the health profession education context.

Table 4. Loading Factor of Items

Instrument Items *(translated from the original Bahasa version)*	***Loading Factor***
Support of Engagement	
Mutuality	
The learning sessions facilitate me to share knowledge with my colleagues.	0.707
The learning sessions help ease the interaction between me and my lecturers.	0.731
The learning sessions provide opportunities for students to exchange ideas.	0.791
The learning sessions allow students to discuss and exchange ideas with the lecturers.	0.751
The opportunity for self-actualization	
Each learning session provides me an opportunity to express my understanding of the topics.	0.749
The curriculum provides me an adequate opportunity to apply my clinical skill towards the patient/simulated patient.	0.749
The opportunity to engage with the patients	
The curriculum provides me an adequate opportunity to interact with real patients	0.915
The curriculum provides me an adequate opportunity to interact with the community.	0.915
Support of Imagination	
Orientation	
The curriculum provides me an adequate opportunity to directly observe a clinical practice.	0.736
The curriculum provides an adequate portrayal of the real condition of health service in the community	0.779
Activities at the clinical skill laboratory demonstrate my ability as a medical doctor.	0.781
Activities at the clinical skill laboratory allow me to perform as a real medical doctor.	0.751
Facility for Reflection	
When I encounter a disconnection between ideal medical practice with reality, the faculty help me to analyze it	0.803
Reflection activity is one of the learning activities applied as part of the curriculum.	0.803
Convergence	
The curriculum facilitates me to better understand the lessons/discipline.	0.787
The curriculum helps ease me to apply the knowledge and skill according to patients' problems	0.772
The previous learning process sufficiently practice appropriate thinking patterns to deal with current learning	0.717
The learning process provides a strong scientific basis to comprehend the next level of learning	0.752
Feedback	
The curriculum facilitates students to gain feedback from peers, nurses, patients, or residents	0.872
The curriculum facilitates students to gain feedback from the lecturers	0.872

At the undergraduate level, DREEM instrument (*Dundee Ready Educational Environment Measure*) developed by Roff et al. (1997) has been used to measure educational environment. This instrument consists of 50 items classified into five constructs, i.e. perception on learning process, learning system organization, self-perception in academics, learning atmosphere, and also self-perception on social. DREEM is widely used in many countries with varied purposes as well as varied validity and reliability reports (Roff, 2005). Several adopters reported unsupported construct validity (Miles, Swift, & Leinster, 2012; Yusoff, 2012). Differing from DREEM, the Pasport CiAME instrument focuses on the curriculum in action which is an implementation of formal curriculum perceived by students, whereas DREEM not only measures the curriculum but also general educational environment. Different from the former curriculum or educational environment measurement instruments, the development of Pasport CiAME instrument is based on the participation concept in the CoP theory. Participation, in this context, is not only students' participation through lectures or other formal instructional processes, but activities related to the medical professional community context. In CoP, participation as a learning process highly depends on the engagement in a group activity, practical share, imagination development, and also aligning process in medical profession work context (Susani, Rahayu, Sanusi, Prabandari, & Harsono, 2015). These concepts are emphasized in this measurement.

The main constructs in this instrument are engagement support, support of imagination, convergence, and feedback. As stated in the introduction, there are three forms of participation, i.e. engagement, imagination, and alignment. Support of engagement in this instrument is formed from mutuality, self-actualization, and opportunities for interaction with real patients and the community. Mutuality that is seen is the togetherness with peers and lecturers who are indeed included in the medical professional community. Interaction with lecturers allows dialogue, discussion about patients, and sharing of experiences as doctors. Not only the interaction with lecturers as clinical supervisors, but also in the continuous interaction with patients will provide opportunities for students to participate and learn (Hägg-Martinell, Hult, Henriksson, & Kiessling, 2017; Steven, Wenger, Boshuizen, Scherpbier, & Dornan, 2014). Good interaction with peers will facilitate the adaptation process of students to the learning environment (Sari & Susani, 2018). The support of imagination construct consists of orientation and facilities for reflection. Both of them can support students to get an overview of the medical profession. Convergence and feedback originate from the alignment concept, but factor analysis shows bad convergence validity if they are used as one construct of support of alignment.

The Passport CiAME instrument can be used to evaluate faculties in providing a curriculum that is capable to support participation as a students' learning process. This instrument utilizes concepts that are independent of local culture, therefore, might be used widely with language adaptation. This instrument can also be used both in the undergraduate program or clinical program. Further research needs to be done to strengthen information on its validity and reliability. Several other validities like predictive validity or concurrent validity were not examined.

Conclusion

The metaphor 'learning as participation' has consequences in the determination and im-plementation of the curriculum for medical students. The Pasport CiAME instrument was developed to measure curriculum implementation that sees learning as participation. This instrument could be a tool to evaluate the magnitude of faculty support for students' participation. The Pasport CiAME instrument which was developed in this study is a multidimensional instrument and has good validity and reliability. It needs strengthening with other studies that reexamine validity and reliability, including predictive and concurrent validity. This instrument may be useful in assisting faculties to evaluate the availability of participation support as a students' learning process in the medical professional community.

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10