

## DEVELOPING ASSESSMENT INSTRUMENTS OF HUMAN COORDINATION SYSTEM FOR GRADE XI HIGH SCHOOL

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### Abstract

*This research about developing 3 types of assessment instrument are cognitive, affective and psychomotor for the topic of human coordination system. This study was a 3-main stages development research namely preliminary, development and formative evaluation stages. The research subjects consisted of two biology teachers and five students for one-to-one, try-out and forty-one students for the small group try-out. The research experts of validation includes one expert in content and one expert in evaluation. The instruments used in this study were a documentation, interview protocols, observations guide and questionnaires. The data were analyzed by using descriptive statistics. The finding of the study are (1) the quality of the three assessment instruments was viewed from the aspect of content and evaluation was valid of a score range of 1 to 3, the content aspects shows a mean score of 3,00, and the evaluation aspect shows a mean score 2,88. (2) The aspect of practicality of the instruments was viewed by biology teachers shows that the developing assessment instruments was in good category. (3) The aspect of interest of the instruments viewed by students in one to one try out is attractive, (4) The result of the small group try-out for cognitive instruments shows that out of 30 items, 21 items were valid and 9 items were not valid with high reliability (value of 0,820); all items of affective assessment instruments related to attitudes on content are valid with high reliability (value 0.913); out of 4 items of psychomotor assessment instruments shows that 3 items are valid and 1 item is not valid with the reliability is unreliable.*

**Key words:** *cognitive, affective, psychomotor assessment instruments, human coordination system.*

### INTRODUCTION

One basic competence that should be possessed by professional teacher is conducting a variety of assessment strategies to evaluate teaching and learning processes and student achievement (Depdiknas, 2007:20). Implementation of the assessment, the teacher must be qualify at the principle of a through and continuous assessment (Depdiknas, 2007:4). In conducting assessment, teacher should do holistic assessment including cognitive, affective, and psychomotor domains (Kementerian Pendidikan dan Kebudayaan Republik Indonesia, 2013:4).

The standard of competence no. 3. describing the structure and function of organ systems in animals or humans as well as disorders / diseases that may occur, with the basic competencies no. 3.6 describing the relationship between the structure, functions, and processes as well as disorders / diseases that can occur in the coordination system in human (Depdiknas, 2006: ). That the learning materials on this basis competency consists

of four types are the facts, concepts, principles and procedures. Matter fact that the disease/disorder coordination system. Namely the concept of matter structure and function on coordination system. Namely the principle of material processes that occur in the coordination system. Material that is indicative of reflex procedure and observation of senses work.

Determining the type of learning material will allow teachers to formulate indicators of achievement in order to develop an alternative assessment. Learning materials on the basis of competence of human coordinate system was hinted assessment to material facts and concepts for the cognitive aspects, material principles and procedures for psychomotor aspects. While affective aspect was always associated with both these aspects. Therefore, the assessment should be the appropriate assessment instruments to measure cognitive, affective and psychomotor.

The results of the analysis of the syllabus and lesson plans were drawn up and used by the teacher in the learning activities, researchers conducted classroom observations and interviews. The results of observations in class show that assessment focused on cognitive aspect, but affective and psychomotor aspects tend to rarely be performed by using appropriate assessment instruments. Affective aspects assessed by noting the active students during the teaching learning process, such as students asked when the discussion class, students who dared to present the results of discussions group, and students who answer questions when the teacher asked questions, it without using affective assessment instrument. Psychomotor aspects was not assessed with psychomotor assessment but rather to assess the practical reports (paper). The result of interviews showed that assessment affective and psychomotor aspects did not use appropriate assessment instruments because teachers did not have an example to develop assessment instruments.

Development assessment instruments for learning biology have been carried out, including attitudes of assessment instruments on material of environmental pollution and efforts to overcome them (Utami, 2011), and the practical assessment instrument on photosynthetic material (Safriati, 2006). However, a comprehensive assessment instrument for a basic competence needs to be developed, in accordance with the Permendiknas No.20 in 2007 that the assessment should include cognitive, affective and psychomotor.

Referring to the above background show that assessment instrument cognitive, affective and psychomotor for human coordination system in this basic competence has difficulty to formulate and develop it. Therefore, research related to assessment instruments cognitive, affective and psychomotor for the competence of human coordination system for grade high school, needs to be developed then conducted research use the format of development research. Research question in this study is *“how to develop and form of cognitive, affective and psychomotor for the competence of human coordination system for grade XI high school?”*

## THEORETICAL FRAMEWORK

Cognitive aspects related to the thinking skills that involve brain activity. Psychomotor aspects related to skills that involve the manipulation of muscle and physical activity. Affective aspect involves five types of characteristics that are attitude, interest, self-concept, morals, and values. Value is one of the characteristics of the type currently prevalent aspect of effective public discussion related to character in education (Sulistiyowati, 2012: 2-3). Implementation of character education should be integrated in the learning carried out of the planning, implementation and assessment of learning. Techniques and instruments were selected and implemented not only to measure academic achievement/ cognitive and skills of students, but also to measure the development of personality (affective) students, therefore teachers should be able to compile the assessment instrument (Gunawan, 2012: 235).

## METHOD

This study is a developmental research. We employed 3 main stages, including: preliminary, development and evaluation. The following Figure 1 illustrate the steps used in the study.

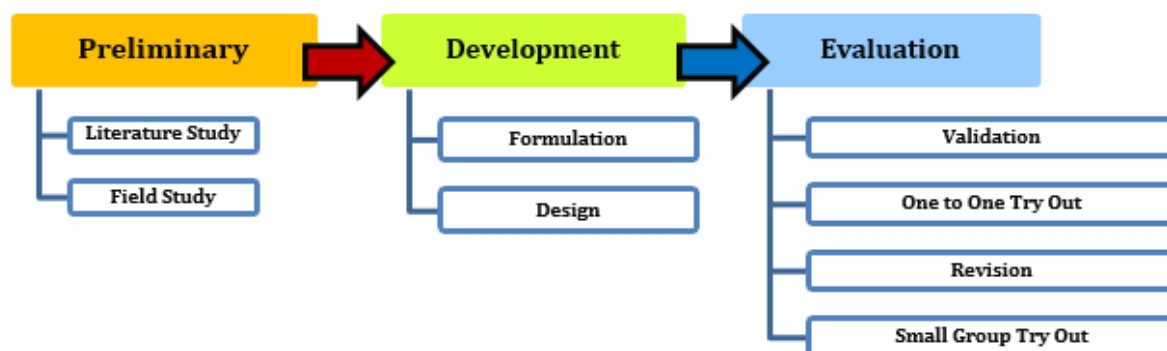


Figure 1: Research procedures

(Borg and Gall in Sugiyono, 2011: 409).

The research subjects in the one-to-one try-out consisted of two biology teachers for practicality and five students for attractiveness, in the small group try-out consisted of forty-one students in SMA Negeri 18 Palembang. The research experts of validation includes one expert in content and one expert in evaluation. The instruments used in this study were a documentation, interview, observations guide and questionnaire. Cognitive assessment instrument is in the form of multiple choice questions. Affective assessment instrument is in the form of questionnaires. Psychomotor assessment instrument is in the form of observation sheets. The data were analyzed descriptively.

### The Data Analysis

- Validation by expert validator analyzed by the formula:

$$X = \frac{\sum x_i}{n}$$

This value is then categorized base by Arikunto, 2006.

- Validity and reliability item :
  - ✓ Item validation was calculated using the point-biserial formula for test and product moment formula for non-test. When  $r$  count is greater than or equal to 0.3 of  $r$  table, then the item instrument is valid.
  - ✓ Item reliability was calculated using the KR-20 formula for test data and Cronbach's Alpha formula for non-tests data. When  $r$  count is greater than or equal to 0.7, then the item instrument is reliable.
- Practicality instrument by students in *one to one try-out* and *small group try-out* was analyzed by descriptive.

### THE FINDINGS AND DISCUSSING

Developing assessment instruments three-main stages of development research are preliminary (literature study and field study), development (formulation of learning objectives and design assessment instrument, and evaluation (*expert validation, one-to-one try out, small-group try out*)).

In school based on KTSP curriculum, it is mentioned that in preparation for syllabi and lesson plan should include the assessment of cognitive, affective and psychomotor. Syllabus prepared by teachers showed that the assessment of cognitive, affective, and psychomotor listed, but in reality the only lesson plan included cognitive assessment. It was impressive that the assessment instrument composed by teachers have not been following the KTSP curriculum. The results of the field study, the assessment focused on cognitive aspects, while affective and psychomotor aspects did not do with affective and psychomotor assessment instruments, because of teachers did not have an example to develop assessment instruments.

The formulation of learning objectives from Standard Competence 3 and Basic Competence 3.6 for human coordination system. Cognitive assessment instrument the form of multiple choice questions, affective assessment instrument the form of attitude questionnaire of the attitudes on content, and psychomotor assessment instrument the form of observation sheet, referred to as the *prototype 1*. Evaluation stage consists of expert validation and One to One try-out, revision and Small Group try out. Validation of the instruments is performed by content and evaluation expert. Redesign *Prototype 1* based on validator suggestion of the assessment instruments can be seen in table 1. Value re-evaluation of the results of assessment instrument scan beseen in Table1.

**Table 1:** The Result of Validation Assessment Instrument

Validator	The average value of validation -1	The average value of validation -2
Content Expert	2,44	3
Evaluation Expert	2,37	2,88

Table 1 shows that the assessment instrument revised according to the advice given by validator. After the revision, the average value of 3 is otherwise valid instrument that can

be used in content and evaluation. Assessment instruments cognitive, affective and psychomotor which is valid both content and evaluation.

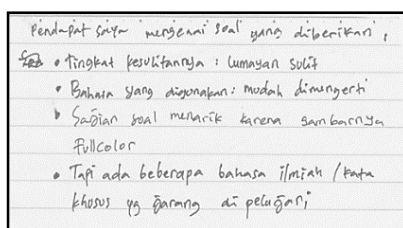
Two biology teachers completed a questionnaire in One to One Try-Out. The result of one to one try out with two teachers biology for an example snippet can be seen in Table 2.

**Table 2:** The Result of One to One Try Out by Teacher

One to One Try Out	Comment and Suggestion
Lenny Ningsih, S.Pd Dra. Siti Aisyah	Assessment instruments that have been practice, it can be applied in the classroom.

The results of one to one try out with two biology teacher show that biology teacher commented that the assessment instrument has been practiced and applied in the classroom. This means that biology teachers agreed to use assessment instruments that have been designed.

One to one try-out test has been done to five students in the form of multiple choice questions to cognitive assessment instrument and in the form of a questionnaire affective attitudes to affective assessment instrument for students feedback on assessment instruments that have been developed. Here's an example snippet test results to students one to one.

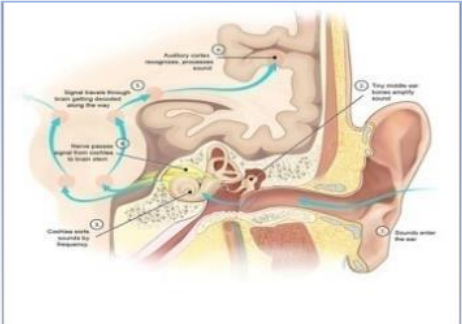
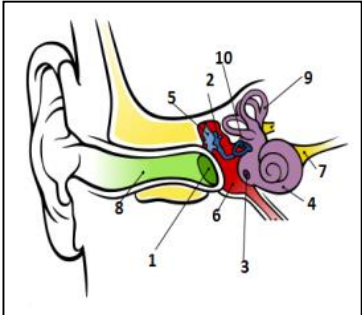


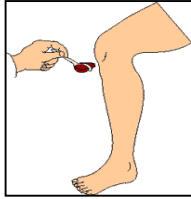
(1) Level of difficulty: Fairly difficult, (2) It has interesting question because the pictures in colorful, (3) Languages spoken: Easy to understand, (4) Some scientific language/special words are rarely studied.

**Figure 2:** The result of one to one try-out by students

Prototype 2 has been validated by validator was valid, then it tested by one-to-one to the teachers and students was declared these instruments could be used (practicality) for small group try-out.

**Table 3:** The result of revision step

Prototype 1	Revision	Prototype 2
<i>Cognitive assessment instrument</i>		
<p>1. Below a picture to hearing mechanism</p>  <p>The correct sequence on the mechanism of hearing as seen in the figure above are :</p> <p>Earlobe, ear canal, ear membrane, the cochlea, ossicular, oval window, tympanic membrane, hair cells, tectorial membrane and basilar, Organ of Corti and the auditory nerve cells, the nucleus auditory, auditory cortex of the temporal lobe.</p>	<ul style="list-style-type: none"> <li>• Those items are have a picture to be functioning properly, adapted to the size of the paper and colors. Need to be repaired.</li> <li>• Choice the answer on items was given information number listed in the figure. Need to be repaired</li> <li>• The language used is simple and simple yet. Need to be repaired</li> </ul>	<p>1. Below a picture to hear mechanism</p>  <p>The correct sequence on the mechanism of hearing as seen in the figure above are</p> <ol style="list-style-type: none"> <li>8-1-6-5-2-10-4-9-6-7</li> <li>8-5-6-3-2-10-4-3-9-7</li> <li>8-1-5-2-10-9-3-6-4-7</li> <li>8-3-1-5-6-2-10-9-4-7</li> <li>8-6-1-5-2-10-3-4-9-7</li> </ol>
<i>The Affective assessment instrument</i>		
<p>The nervous system of Involuntary consists of sympathetic and parasympathetic neural are functionally antagonistic reaction both, although both synergy antagonists work together in regulating the body in balance mechanism of the body.</p>	<p>Attitude measurement should organize components of attitude is cognitive, affective and conation in the form of positive and negative statements. Need to be repaired</p>	<p>Autonomic nervous system consists of a sympathetic and parasympathetic neural, the functional performance of the two antagonistic but both of them work together in the body balance mechanism. The analogy in daily life, even though we are different but have to appreciate and respect the differences, however I dislike to friend's opinion.</p>

Prototype 1	Revision	Prototype 2
<i>The Psychomotoric assessment instrument</i>		
<p><i>Indicator</i> The position is sitting in a chair with a free state or a relaxed and eyes closed.</p> <p><i>Descriptor</i></p> <ol style="list-style-type: none"> <li>1. The sitting position is wrong.</li> <li>2. The sitting position is not free</li> <li>3. The correct sitting position but stiff or not relaxing with eyes closed.</li> <li>4. The correct sitting position and in a free state or relaxed with eyes closed</li> </ol>	<p>lapped to the performance assessment scale in practical activities. Need to be repaired</p>	<p><i>Indicator</i> Indicates occurrence of tendon reflexes in humans.</p>  <p><i>Descriptor</i></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Student hits the correct position.</li> <li><input type="checkbox"/> The position of leg in a normal condition.</li> <li><input type="checkbox"/> Eyes close</li> <li><input type="checkbox"/> Hit patellar ligament.</li> </ul>

The development assessment instruments for human coordination system resulted the assessment instruments cognitive, affective and psychomotor and tested on small group try-out by Prototype 2. Only content which already valid in term of construct validity and passed the expert validation, will become the material tested in the second prototype. The following table description of assessment instruments form of cognitive, affective and psychomotor in Prototype 2 can be seen in Table 4.

**Table 4:** The Result of Validation and Reliability Items Prototype 2

Instrument	Validation Test	Realibility Test
Cognitive	21 item valid 9 item invalid	0,820 ( <i>High Reliability</i> )
Affective	15 item valid	0,913 ( <i>High reliability</i> )
Psychomotor	3 item valid 1 item invalid	0,067 ( <i>Not Reliability</i> )

Cognitive instruments shows that out of 30 items, 21 items were valid and 9 items were non-valid with high reliability (value of 0,820); all items of affective assessment instruments related to attitudes on content are valid with high reliability (value 0.913); out of 4 items of psychomotor assessment instruments show that 3 items are valid and 1 item is non-valid with the reliability is unreliable.

The results of the literature study obtained information on the syllabus stated that assessment of cognitive, affective and psychomotor but on the lesson plan only attached cognitive assessment, the assessment suggests that the instruments are prepared by teachers only cognitive aspects of the instrument. This is because of teachers did not have examples of appropriate assessment instruments for affective and psychomotor

assessment instrument. Constraints of the teachers in preparing affective and psychomotor assessment instruments besides no examples of instruments, the problem was due to take time in the preparation of instruments while teachers have other duties such as class guardian teacher, teacher workload becoming one of the main activities such as preparing lesson plan learning devices (Sekretariat Negara Republik Indonesia, 2008), teachers not only teach one grade level but also charged at different grade level for qualification of certified teachers who need 24- hour face-to -face in one week (Sekretariat Negara Republik Indonesia, 2008).

Instrument development activities requires skill and creativity of teachers in arranging. In addition, teachers tend to not use the instrument in the form of sheets of observations and psychomotor attitude because the implementation will spend time of learning to observe the allocation of student activities while teachers have to manage learning in accordance with the allocation of time in order to achieve competency to be achieved by students.

Assessment instrument development phase begins with formulating the learning objectives of the standard indicators and basic competencies. Formulation of learning objectives and assessment instruments lattice formulation is made to ensure that the items are made later in accordance with the applicable curriculum. Sudaryono (2012) illustrated that the preparation of the grating instrument as a guide in developing useful items was due to ensure a good sample questions cover all of the subject means proportionally.

The results of the initial design instrument called *prototype 1*. The results of validation and evaluation of materials experts note that the average value of the validity of 3 declared valid. *Prototype 1* which have entered a valid test phase one to one try-out by teacher showed the practicality of the use of the instrument in terms of the constraints that there are no obstacles in its use because it has a usage instruction manual, guidelines include answer keys, scoring and interpretation of the value, in terms of effective and efisien of time that can be effective and efficient. Sudijono (2011) argued that practicality is eligible, raised the instrument should be simple meaning, it does not require much equipment and complete means comes briefing, answer key, scoring guidelines and values.

*Prototype 2* is tested in a small group then determined the validity and realibility. The most of the grains and the statement are valid indicators of activity, while there are aspects of assessment who has low reliability are the psychomotor assessment instruments. While the item is valid due to the suitability or the alignment direction of the scores on items related to item with the total score, so that there is a significant positive correlation between the scores of items with total scores. Items declared invalid are influenced by the level of item difficulty, item discrimination power and function of distractor items. Items that have a degree of difficulty of the items which are difficult or



easy cause that bad items. It does not distinguish high-ability students and low-ability and the ability of the student to the same level on the item.

In addition, the invalid items can also be affected distractor function of available options, the options available should be represented on the answer selected by the student. An unselected option means that the option is not working well because it did not give a stimulus to interest student to choose that option, so the value of the distracter is low (Sudaryono, 2012).

The low reliability of psychomotor assessment instruments is due to the grain used (limited to the practical implementation indicators), the more points are tested, the value of reliability will be higher, this is due to the limited spread of scores due to the greater spread of scores, the higher reliability (Uno, Hamzah and Koni, 2012). This means that there is a link between the item with other items. Sudarsono (2012) argues that high value of reliability is due to the correlation between items. The greater value of the item correlation (positive correlation coefficient), the larger the value of reliability, it influenced spread of scores of items with a total score.

## CONCLUSION

Assessment instruments of cognitive, affective and psychomotor development through the method of development of R & D by step development through the preliminary stage (the study of literature and field studies), stage of development (formulation of learning objectives and preliminary design assessment instruments) and the evaluation stage (validation experts, one to one try out, revision and small group try out). Forms of assessment instruments cognitive, affective and psychomotor who have valid through content and evaluation, and practical through try out one to one called Prototype 2. Prototype 2 tested to a small group try out and known that assessment instrument is effective because it can be used by teachers. Cognitive items that out of 30 items, 21 items were valid and 9 items were not valid with high reliability (value of 0,820); all items of affective assessment instruments related to attitudes on content are valid with high reliability (value 0.913); out of 4 items of psychomotor assessment instruments shows that 3 items are valid and 1 item is not valid with the reliability is unreliable.

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