



Standard Assessment Model for Scientific Integration-Interconnection As Material for Evaluation of Vision and Mission Achievement

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Abstract: This study aims to develop a standardized assessment model of scientific integration-interconnection, which begins with conducting a literature review and needs assessment, setting goals, developing initial products, validating contents, testing readability, testing instruments, analyzing results, and ending with an interpretation of the results of the assessment. The method used is Research and Development. Testing of the assessment instruments was carried out for each element of the Tridharma of Higher Education, namely 76 lesson plans, 139 research and development works, and 41 community service works. The scientific integration-interconnection assessment model has characteristics according to the structure of the second order model, with the first order being 4 scientific integration-interconnection domains (philosophical domain, material domain, methodological domain, and strategic domain) and the second order is 15 aspects of scientific integration-interconnection. Data analysis techniques using Aiken-V, Exploratory Factor Analysis/EFA and Confirmatory Factor Analysis/CFA, Omega, Item Response Theory approach of polytomous scoring, and descriptive statistics. The assessment model is feasible, fulfilling the criteria of content validity, construct validity ($p\text{-value} = 0.11949$ and $RMSEA = 0.027$), estimated instrument reliability ($\alpha = 0.816$), and construct reliability ($\omega = 0.939$). The scoring used the GRM approach with good quality in terms of the results of the 94% item fit test with an item discrimination index of $0.655 < DISC_i < 1.153$ and the average item difficulty level of $-1.965 < DIFF_i < -0.662$.

Article History

Received: 27-06-2023
Revised: 30-07-2023
Accepted: 15-08-2023
Published: 16-09-2023

Key Words:

Assessment Model;
GRM Approach;
Mathematics
Education;
Scientific
Integration-
Interconnection;
Achievement of
Vision and
Mission.

How to Cite: Dewanti, S. (2023). Standard Assessment Model for Scientific Integration-Interconnection as Material for Evaluation of Vision and Mission Achievement. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran*, 9(3), 771-781. doi:<https://doi.org/10.33394/jk.v9i3.8638>



<https://doi.org/10.33394/jk.v9i3.8638>

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Introduction

One of the quality indicators that people consider in choosing a university/study program as a destination for studying is accreditation (Kumar et al., 2020). Accreditation is an assessment activity according to predetermined criteria (Higher Education National Accreditation Board, 2019). In Higher Education, this assessment activity includes educational standards, research standards, and community service standards. Accreditation as an external quality assurance system is part of the higher education quality assurance system (Makhoul, 2019). Therefore, the eligibility of a study program and tertiary institution based on criteria that refer to the National Higher Education Standards is determined through accreditation. In addition, accreditation aims to guarantee the quality of study programs and tertiary institutions externally in both the academic and non-academic fields to protect the interests of students and society.

Assessment of the quality of the study program includes nine criteria ranging from the vision, mission, goals, and strategies of the study program to the outcomes and achievements of the Tridharma of Higher Education (Higher Education National Accreditation Board,

2019). Accreditation includes an assessment of the ability of the study program to recognize external conditions that influence its existence and development, the ability of the study program to describe its profile on several important and strategic aspects, as well as the ability of the study program to analyze and determine future development programs. Clarity, realism, and linkages between the vision, mission, goals, objectives, and strategies for achieving the goals of the study program are the first things asked by the assessors as the assessment team. The study program has a scientific vision and mission, which is clearly stated in line with the vision of the managing institution. Vision is the big goal of an institution that is used as a guide so that all parties can go toward the same goal (Bowen, 2018; Roblek & Meško, 2018).

To realize the vision that has been set, a mission is needed in the form of tasks that must be carried out by the study program. Bowen (2018) explains that a mission is an effort or action to realize the vision. The mission of the Mathematics Education Study Program at UIN Sunan Kalijaga Yogyakarta is in the form of steps to realize the vision, namely starting from developing mathematics education and a culture of research innovation, carrying out community service, and increasing collaboration with various parties involved in the field of mathematics education (Independent Learning Curriculum Development Team, 2020). To achieve this goal, of course, a strategy is needed in the form of actions or activities carried out by the institution to achieve the goals that have been set (Educational Independent Accreditation Institute, 2021). The goals and objectives of the study program are reflected in the tridharma outcomes, namely graduates, research results, and community service (Rusilowati & Pratiwi, 2022). The idea of the Tridharma of higher education is not just sorting out the three dharma and carrying out the dharma of education, research and service separately. The three dharma must form a unity and are designed to be cycles of activities that support each other, making inputs as well as outputs. The results of research-oriented community service must be able to be applied directly by the user community so that their standard of living and welfare increases, can be used to solve problems faced by the community, social engineering, increase intellectual property, and become a reference for policies that can be implemented by the community, the business world, industry, or government at the national level (Syahza, 2019).

The concept of integrating the tridharma of higher education is based on the idea that the implementation of learning, research, and community service is an inseparable unit (Yusup et al., 2021). The three dharma are designed to be a cycle of activities that support each other, become inputs, processes, as well as outputs and outcomes as well as impacts for sustainable national development by the profile of study program graduates (Rusilowati & Pratiwi, 2022). Integrative-interconnective will form competence of having high curiosity, active, creative, critical, persistent, diligent, good at working together, interpreneurship, overflowing mentality, high integrity, passionate, tough, independent, has high endurance, trust and can be role models, and master the science of mathematics education in depth. An integrative-interconnective approach is an approach that seeks mutual respect; general science and religion, aware of each other's limitations in solving human problems. This will give birth to a collaboration, at least a mutual understanding of approaches and methods of thinking (processes and procedures) between the two disciplines (Abdullah, 2010). The philosophy of scientific integration is described by three pillars, namely ontology, epistemology, and axiology (Abdullah, 2014).

The Vision Mission Goal Strategy (VMGS) of the Mathematics Education Study Program has been prepared based on the VMGS of UIN Sunan Kalijaga and the Tarbiyah and Teacher Training Faculty as the Study Program Management Unit. The drafting process has

also followed the standards set by the Quality Assurance Institute of UIN Sunan Kalijaga. As part of UIN Sunan Kalijaga, the Mathematics Education Study Program has VMGS aligned with universities that have core values of integration-interconnection. This core value is reflected in the VMGS Mathematics Education Study Program, namely the integration and development of mathematics education with Islamic knowledge, which means that all stakeholders in the mathematics education study program must be able to combine these two things. Evaluation related to VMGS has been carried out periodically by the Quality Assurance Institute through monitoring and evaluation activities, Internal Quality Audits, and Follow-Up Audits. However, the evaluation carried out was only limited to the number of outputs and achievements of the Tridharma of Higher Education. Even though the evaluation of the achievement of VMGS also needs to be assessed in terms of quality, namely by tracing the suitability of the content in each Tridharma Higher Education activity with the VMGS study program.

The concrete steps of the mathematics education study program in integrating the two are reflected in the lecture activities. To find out whether lecturers have implemented scientific integration-interconnection, a student satisfaction survey has been conducted at the end of each lecture, but the results are not detailed enough. Meanwhile, the portion of students who integrate science and Islam is in the final assignment research, namely the mathematics education study program gives freedom to students to conduct research that integrates their knowledge with Islam. In addition, lecturers began to carry out scientific integration in research activities and community service. However, the achievements of the VMGS in implementing higher education Tridharma have not been comprehensively measured. Therefore, it is necessary to develop a standard assessment model of scientific integration-interconnection as material for evaluating the achievement of the vision and mission of the mathematics education study program.

Research Method

This research method is Research and Development (R&D) using the development research model (Borg & Gall, 1983) which begins with an assessment of the results of previous research relating to the validity of the components in the product to be developed, then developing it into a product, testing of designed products, and reviewing and correcting those products based on trial results. The development of this standardized assessment model contains guidelines for the steps taken by the researcher so that the planned results have a standard of eligibility in developing a reference needed regarding the procedure for the results or product to be developed.

The standard assessment model of scientific integration-interconnection that has been designed is tested to prove the validity and reliability of the product. This test includes three stages of testing, namely expert review, limited trial, and expanded trial. An expert review is part of a qualitative product analysis, which tries to see how the quality of the product is viewed theoretically. The method used is Focus Group Discussion by inviting scientific integration-interconnection experts (3 validators), psychometric experts (2 validators), methodological experts (1 validator), and language experts (1 validator). The purpose of this expert review is to prove theoretically (content validity) related to the assessment of scientific integration-interconnection. The results of the expert review were in the form of information about content validity which was analyzed using Aiken's formula (Aiken, 1985).

A limited trial was conducted to obtain information about the quality of the assessment model as material to be used for improvement/revision to obtain the right integration-interconnection assessment model. The results of this limited test will be used as

information in improving the assessment model product for scientific integration-interconnection. Products that have received expert advice and have carried out limited trials, then the products will be used and tested extensively. The purpose of this broad analysis is to analyze the construct validity, instrument reliability as well practicality and effectiveness of the products made. Such information will be able to answer research questions. Testing of the assessment instrument was carried out for each element of the Higher Education Tridharma with the following test subjects.

Table 1. Assessment Instrument Trial Subjects

Higher Education Tridharma Elements	Assessment Subject	Many Subjects
Element 1: Education and teaching	Semester Learning Plan of compulsory courses for all graduate profiles (Educators/Mathematics Teachers, Edupreneurs, and Researchers) in the independent learning curriculum	76
Element 2: Research and development	Research and development work carried out by lecturers or with students in the last three years.	139
Element 3: Community service	Community service works carried out by lecturers or with students in the last three years	41
Total		256

Data analysis techniques with a qualitative approach are used to analyze the validation of the model on the opinions, suggestions, and judgments given by experts. Suggestions from experts include 1) content validity regarding the dimensions, aspects, and indicators of scientific integration-interconnection that have been compiled based on theoretical studies; and 2) material, construction, and language aspects. Quantitative data analysis techniques are used to analyze validity (content and construct) and estimate reliability, then the accuracy of the scientific integration-interconnection construct is known from the results of construct validity analysis (EFA and CFA) and construct reliability. The standard assessment model of scientific integration-interconnection is determined by the Item Response Theory approach of polytomous scoring. Furthermore, descriptive statistics are used to determine the achievement of the vision and mission of the Mathematics Education Study Program in terms of scientific integration in the Tridharma of Higher Education, as well as to prepare guidelines for interpreting assessment results.

Results and Discussion

The initial design of the assessment model was prepared based on literature reviews and field studies in order to obtain a scientific integration-interconnection assessment construct. The assessment construct is used to compile the assessment items and is packaged in the form of an assessment instrument. The standard assessment instrument for scientific integration-interconnection consists of 3 parts, namely 1) instruments for assessing elements of education and teaching; 2) instruments to assess elements of research and development; 3) instruments for assessing elements of community service. The target of the assessment of the elements of education and teaching is the Semester Learning Plan document. The assessment targets for research and development elements are research and development documents both carried out by lecturers, and students, as well as collaborations between students and lecturers. Research documents can be in the form of reports, articles in journals, theses, and product development results. The target of the assessment on the element of community service is community service documents in the form of reports, articles in journals, and products resulting from community service.

Table 2. Assessment of Scientific Integration-Interconnection

Realm	Aspects of Scientific Integration-Interconnection
A. Philosophical	A1. An existential fundamental value in integrating between disciplines
	A2. An existential fundamental value in interconnecting disciplines
	A3. Existential awareness that a discipline always depends on other disciplines
	A4. Existential fundamental values about humanistic values
B. Material	B1. Study weighting between Islamic and religious sciences with education, mathematics, and mathematics learning
	B2. The use of terms/names that show the relationship between general disciplines and Islamic sciences
	B3. Insertion of other scientific theories or integration between sciences (general science and Islamic science)
	B4. Linking other disciplines in epistemology integration
	B5. Linking other disciplines in the integration of axiology
C. Methodology	C1. Approaches to integrating knowledge
	C2. Approaches to interconnect knowledge
	C3. Methods for integrating knowledge
	C4. Methods for interconnecting knowledge
D. Strategic	D1. Physical, psychological, and emotional involvement
	D2. Use of active learning models
	D3. Involvement in thinking, discussing, investigating, and creating

The assessment instrument was then reviewed in content by the validator team, which included material, construction, and language aspects. The material aspect is related to the suitability of the item with the scientific domain and integration-interconnection aspects, and the construction aspect is related to the formulation of short statement items (the length of the statement), clear (not double meaning), and firm, while the language aspect is related to the use of language and vocabulary by the rules of the Indonesian language and a variety of communicative languages. Based on the Aiken table, a statement item is said to be valid if the validator's agreement index regarding content validation is at least 0.75 (agreement index with 7 validators with 5 categories). The results of the content validation show a minimum value = $0.786 > 0.75$, so it can be concluded that all statement items in the 3 assessment instruments are content valid.

The construct of the scientific integration-interconnection assessment model is determined based on theory, then the proof is carried out with EFA and CFA. The first step of factor analysis is to carry out the Kaiser-Meyer-Olkin (KMO) and Bartlett's tests to determine sample adequacy. The output of the KMO and Bartlett's tests showed $KMO = 0.812 \geq 0.5$, meaning that many test subjects in this assessment had sufficient samples (Sarstedt & Mooi, 2019). The significance of Bartlett's test is 0.000 which shows $\text{sig.} < 0.05$, meaning that the correlation matrix is not an identity matrix, so the data forms a correlation matrix with a close relationship between variables. Each item has a contribution to the instrument, as evidenced by the output of communalities with a minimum communality of $0.537 > 0.3$ on item C3, meaning that the criteria are met, namely that all items have a contribution to the instrument.

Based on the EFA with the varimax method, the grouping of items is obtained according to the constructs arranged based on the theory. The rotated component matrix (Left Figure) shows 16 aspects grouped into 5 factors, while the Rotated component matrix (Right Figure) shows 15 aspects (without item B2) grouped into 4 factors according to theory. This result indicates that item B2 should most likely be eliminated. The results of this EFA form the basis for conducting CFA. CFA aims to test whether the data match the hypothesized model. Assessment of scientific integration-interconnection is a second-order CFA because

the latent variables are not directly measured through the indicators, but through latent variables in the first order which are considered indicators. Following are the results of the CFA assessment of scientific integration-interconnection.

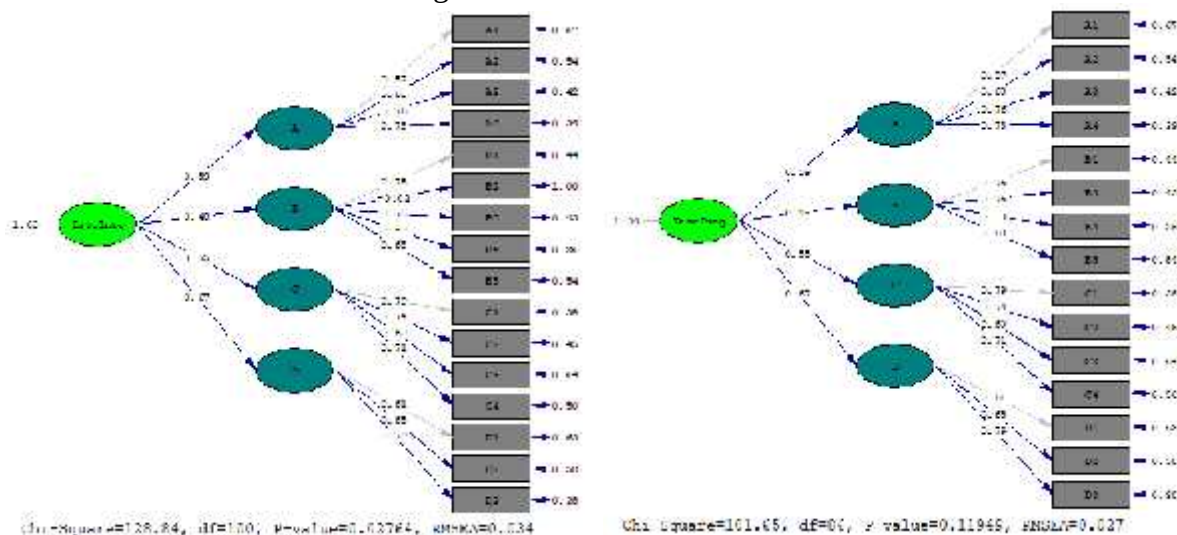


Figure 1. Output of Scientific Integration-Interconnection Standardized Solution

The scientific integration-interconnection assessment model construct requires modification by eliminating item B2 to become a valid construct with $p\text{-value} = 0.11949 (\geq 0.05)$ and $RMSEA = 0.027 (\leq 0.08)$. Each loading factor, both factor loading for the second order construct and factor loading for the first order construct, is fit because it meets the criteria for factor loading ≥ 0.3 (Sarstedt & Mooi, 2019). This result indicates that item B2 is invalid, so item B2 is eliminated. The scientific integration-interconnection assessment model has 4 latent variables and 15 aspects, which are divided into 1) the philosophical realm consists of 4 aspects; 2) the material realm consists of 4 aspects; 3) the methodological domain consists of 4 aspects; and 4) the strategic domain consists of 3 aspects.

Instrument reliability shows that the consistency of the instrument is estimated with a Cronbach Alpha value $\alpha = 0.815 \geq 0.7$, indicating that all items are reliable (Sarstedt & Mooi, 2019; Wells & Wollack, 2003). Construct reliability can be estimated based on the factor load of each indicator making up the instrument and the unique error index of each indicator. Construct reliability calculations can use the Omega (ω) reliability formula, which only involves factor loading (λ). The construct reliability estimates $\omega = 0.939 \geq 0.7$ indicates that the construct of the scientific integration-interconnection assessment model is reliable.

The dimensionality test is carried out to analyze many different latent variables in determining the score of each item. The results of the dimensional test show that this test measures one dimension shown from the eigenvalues. The percentage of the first component eigenvalue of 28.256% ($> 20\%$) indicates that the assessment of the scientific integration-interconnection of the Mathematics Education Study Program measures one dimension. The eigenvalue results also show that the instrument can assess scientific integration-interconnection by 64,704%.

The standard integration-interconnection assessment model has unidimensional characteristics with a good quality Graded Response Model (GRM) score when viewed from the results of the fit test and the resulting item parameter values. GRM is used for categorical responses and is the development of the 2PL IRT model, which can reveal two item parameters, namely difficulty level, and discriminating power. The results of the model fit test show that 94% of the item fit with the resulting item parameter values are in a good

category, namely the item discrimination index lies at interval $0.655 < DISC_i < 1.153$ and the average item difficulty level lies at the interval $-1.965 < DIFF_i < -0.662$.

Guidelines for interpreting the results of the assessment were compiled using descriptive statistics by considering an average of 55.543 and a standard deviation of 8.114 with categories according to the normal distribution. Based on the guidelines for interpreting the results of the assessment, the distribution of the results of the scientific integration-interconnection assessment for each element of the tridharma of higher education and as a whole.

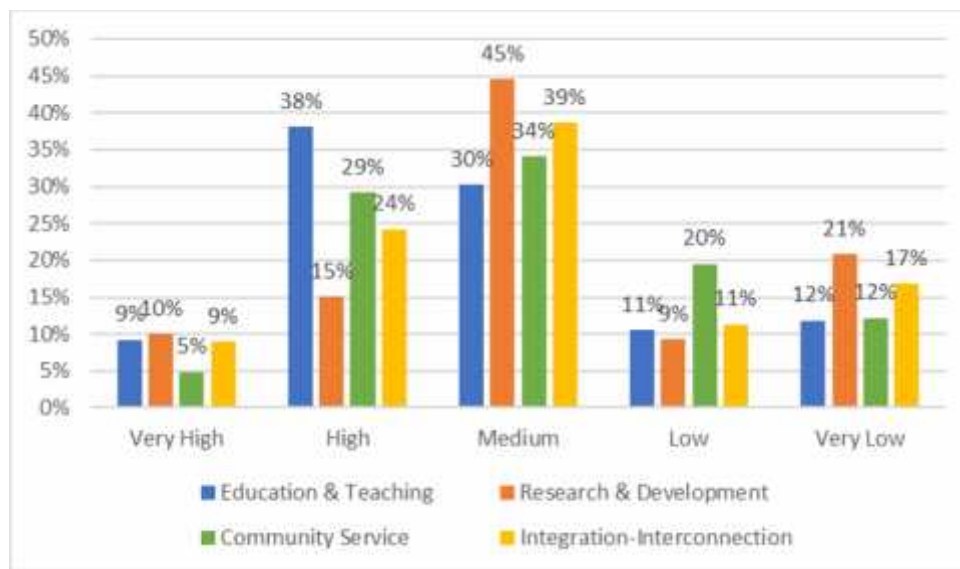


Figure 2. Percentage of Scientific Integration-Interconnection Assessment Results

The results of the scientific integration-interconnection assessment show that most of the Tridharma elements of higher education in the Mathematics Education Study Program are at medium and high levels. This indicates the achievement of the scientific vision of the Mathematics Education Study Program, which has a target of becoming a center for the study and development of mathematics education that combines science, Islam, and inclusivity. Scientific integration is carried out by combining certain values with a different concept so that it becomes a unity and cannot be separated. In education and teaching, research and development, as well as community service carried out in the Mathematics Education Study Program, it has integrated and interconnected science and produced courses and works that combined mathematics education with Islam, mathematics education with culture, mathematics education with inclusiveness, mathematics education with technology, and mathematics education with psychology. In addition, various works that integrate and interconnect various disciplines are also produced and used as lecture references.

The integration-interconnection of mathematics and Islamic education can be seen in the results of the development of the integration-interconnection module with a scientific approach (Ulwyah et al., 2022). Integration-interconnection insight is applied in the realm of material and strategy. The material domain is the process of integrating mathematical material with other sciences and vice versa, then the realm of strategies for applying a scientific learning approach. The integration implemented in the modules developed is not only related to Islamic material but also in a broader context, namely associating and connecting some material in mathematics, religious studies (Islam), general knowledge, and everyday life using a scientific approach. Research conducted by Ulfaini and Permatasari (2022) produced a mathematics module that integrates contextual approaches and Islamic values. In addition, the integrations of educational science and Islam are found in research

conducted by Fadillah et al. (2020) regarding efforts to improve students' spiritual intelligence through student management.

Ridha, Ngasimurrohman, Ulfaini, Ekarini, and Ibrahim (2020) conducted integrations of mathematics education with inclusiveness regarding the problems of students with hearing disabilities in learning mathematics in inclusive schools. The application of peer tutoring with realistic mathematics education in inclusive classes to improve problem-solving skills was carried out by Putranto, Marsigit, and Ratnasari (2022). Integration-interconnection of mathematics and cultural education is carried out by utilizing miniature *joglo* houses in learning to understand flat shapes and geometric shapes (Muwaffiq & Suparni, 2022). Ethnomathematical exploration was carried out on the Eid ketupat tradition (Utami et al., 2022), and the building of the Jami' Darul Mutaqqim Mosque with the mathematical concepts found were numbers, number operations, three and two-dimensional shapes, geometric transformations, and integral (Permatasari, 2022). Ethnomathematics in the local culture of Kawung batik is used as a visual aid or media in learning mathematics to understand the concepts of congruence and congruence and the concept of geometric transformation (Sa'id et al., 2021). Applying a realistic mathematical approach to flat-shape material through the culture of Kampung Kuta (Adilaturrahmah & Suparni, 2021).

The integration of learning mathematics and technology is carried out by developing android mobile apps as a media for learning mathematics based on a contextual approach to facilitate understanding of concepts (Basya et al., 2019). Developing an android deck card educational game to facilitate student understanding of fractional material concepts (Firdausi & Suparni, 2022). Development of mathematical comics using the help of the manga studio application (Saputra & Azka, 2020). Utilization of technology as a learning medium in the form of computer-assisted learning using Cabri 3D (Nurjanah et al., 2020), and e-learning-based learning videos (Jamaliyah & Wulandari, 2022). In addition, teachers should understand the developing social media technology and be able to apply it to mathematics learning, because social media is a technology that is almost always accessed by students (Azka, 2019). Psychometry can also be integrated into mathematics education, which is used to examine the characteristics of mathematical literacy items (Dewanti et al., 2021) and to develop a scale of students' attitudes toward mathematics (Dewanti et al., 2020).

The integration and interconnection of various disciplines are demonstrated by the development of project-based mathematics learning models within the framework of Sciences, Technology, Engineering, Mathematics, and Islam (STEMI) by Nu'man, Retnawati, Sugiman, and Jailani (2022). The learning model recommends efforts made by math teachers to strengthen mathematics in STEM education by prioritizing math content, using specific approaches, and using projects or problems in STEM education. Furthermore, a confirmatory factor analysis was carried out to determine the dominant factors of Self-Regulated Learning within the STEM framework (Nu'man et al., 2021).

The realm of scientific integration-interconnection includes the philosophical realm, the material realm, the methodological realm, and the strategic realm. Integration-interconnection in the philosophical realm of teaching means that each course must be given an existential fundamental value about other scientific disciplines and their humanistic values (Abdullah, 2021). Integration-Interconnection in the material domain can be done with three models, namely 1) the integration model into the curriculum package; 2) a course naming model that shows the relationship between general disciplines and Islamic sciences; and 3) integration models into course themes. Integration-interconnection in the methodological realm is carried out using approaches and methods by the development of the science concerned. Integration-interconnection in the strategic realm is carried out in the

implementation or praxis of the learning process with characteristics, interactive, holistic, integrative, scientific, contextual, thematic, effective, collaborative, and student-centered.

Conclusion

The scientific integration-interconnection assessment model has characteristics according to the structure of the second-order model. The realm of scientific integration-interconnection includes the philosophical realm, the material realm, the methodological realm, and the strategic realm. The scientific integration-interconnection assessment instrument is of good quality in terms of content validity, construct validity, instrument reliability, and construct reliability. The standard integration-interconnection assessment model has unidimensional characteristics with a good quality GRM score when viewed from the results of the fit test, and the resulting item parameter values are in a good category. There are three integration-interconnection assessment instruments, namely assessment instruments for education and teaching elements, assessment instruments for research and development elements, and assessment instruments for community service elements.

Recommendation

The scientific integration of the Mathematics Education Study Program is in the Moderate category, so it is advisable to study more deeply in integrating and connecting between disciplines. The results of this study can be used as material for consideration in reviewing the curriculum, followed by the preparation of lesson plans and roadmaps for research, development and community service. The focus of the assessment is on Semester Learning Plan documents, research and development works, and community service works, so that it can be suggested for the development of further assessment models that can also assess the process of implementing the Tridharma of Higher Education.

Acknowledgements

Researchers would like to thank UIN Sunan Kalijaga Yogyakarta for providing research funding through the Public Service Agency with faculty development policy research clusters and study programs in 2022.

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