# The Integration-interconnection Paradigm in Learning Mathematics through Development Research and Clinical Supervision

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Abstract:      The integration-interconnection paradigm is a scientific basic framework developed at UIN Sunan Kalijaga Yogyakarta. However, the learning model that should be developed to implement integration-interconnection between Islamic studies and science-technology concepts, as well as the internalization of Islamic values in society still needs to be examined. Therefore, developmental research with four-D model was conducted to find math learning model, combined with clinical supervision that aimed to improve the quality of integration-interconnection learning based. The results showed the existence of different interpretations between lecturers on learning model used for each level of integration-interconnection paradigm. Therefore, integration-interconnection experts are required to define every element in integration-interconnection level, operationally. Moreover, clinical supervision is required to reduce, or even eliminate, differences in observing the implementation of integration-interconnection in learning. In other words, it should refer to the standard professional development that includes the expertise, responsibilities and collegial principles.

## 1 INTRODUCTION

The integration-interconnection is a scientific paradigm developed at UIN Sunan Kalijaga Yogyakarta, and particularly for the Faculty of Science and Technology, it is a distinctive scientific identity and characteristics. The paradigm itself has been elaborated in syllabus, lesson plan or *Satuan Acara Perkuliahan* (SAP), learning process, evaluation, and academic administration guidelines (Anonim, 2004).The integration-interconnection approach in learning process not only involved the domain of Bloom's taxonomy but also entered the domain of Islamic education (*'ilm*, *iman* and *amal*).

Therefore, curriculum developed at the Faculty of Science and Technology, UIN Sunan Kalijaga Yogyakarta is aimed to achieve a scientific framework of science and technology (*hadlarah al-ilm*) that integrated and interconnected with Islamic studies (*hadlarah al-nash*) and ethics (*hadlarah al-falsafah*). Until now, the integration-interconnection paradigm in faculty's curriculum has been delivered through several models, following the dynamics of curriculum changes in Indonesia. It is strayed with a content-based curriculum that emphasizes on integration-interconnection materials needed to be delivered to students. Then, it is turned into a competency-based curriculum (CBC) that oriented in achieving graduate standards of competence, in which the integration-interconnection paradigm is delivered through development of SAP that relevant to certain conditions and needs. Now, the curriculum that is being developed is CBC-IQF (CBC-Indonesian Quality Framework),a curriculum oriented to the achievement of learning outcomes in the aspect of attitudes, generic skills or managerial, as well as specific skills and knowledge in a field of expertise. This is certainly an opportunity as well as a challenge in developing curriculum based on integration-interconnection paradigm, particularly related to designing learning model that can implement the concept of integration-interconnection between Islamic studies and science-technology, as well as to internalize Islamic values in society, especially in the profession of expertise.

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The author, along with a few colleagues, has done developmental research with four-D model to search integration-interconnection model at the Faculty of Science and Technology, UIN Sunan Kalijaga Yogyakarta. One of the phases is development phase. In this phase, we made a learning prototype based on various discourses about integration-interconnection. The integration-interconnection domains (philosophy, material, methodology, strategy) were combined using integration-interconnection model in learning implementation. As a result, we obtained a blue print of disseminated draft models (Wardati et al., 2007) to observe the implementation of integration-interconnection paradigm in learning mathematics specially in class Calculus I.

The results showed that the lecturers of Calculus I had tried to implement integration-interconnection learning approach on the level of material and philosophy, using similarity, parallelize, complementation, comparisons and inductive models. However, those lecturers had different perceptions in observing integration-interconnection aspects about the level and model of integration-interconnection. Those differences need to be reduced or, if possible, eliminated, to find an integration-interconnection learning model that can be implemented in general, particularly at the Faculty of Science and Technology (Khurul W., et al., 2007).

In addition to determine integration-interconnection learning model, we also have conducted a clinical supervision in madrasa (Khurul W., 2007).The clinical supervision in madrasa involved eight mathematics teachers in MTs (Madrasa Tsanawiyah) and MA (Madrasa Aliyah). Clinical supervision is a form of professional help which is done systematically from planning, observation, until intensive analysis, based on lecturers (teachers) needs. Clinical supervision model that commonly used is collaborative and cooperative. It is expected that through clinical supervision, lecturers (teachers) can find a way to increase their teaching ability and skills. After observation, the selected teacher model was teacher from MTs UIN SunanKalijaga Laboratory. This experience inspired us to examine the discourse of elaborated clinical supervision with development research in the implementation of learning improvement models (clinical supervision) based on integration-interconnection paradigm. Therefore, this paper aims to:

1. Identify the learning improvement model based on integration-interconnection paradigm through clinical supervision
2. Elaborate the implementation of clinical supervision through research development using four-D model

## 2 THEORITICAL FRAMEWORK

Many people assume that learning is related to school activities, which consist of reading, writing and counting activities. In fact, learning is a complex process that involves the relation between different aspects, so that learning can be said as a system (Mulyasa, E., 2005). Three important things that characterize a system are:(1) have a purpose, (2)contains a process and (3) the process always involve and use various components or certain elements (Sanjaya, W., 2006). The theoretical framework related to the discussion in this paper consist of integration-interconnection approach, clinical supervision dan development research with four-D model.

### 2.1 The Integration-interconnection Approach

UIN SunanKalijaga has tried to establish a dialogue and collaboration between various disciplines, which later known as the integration-interconnection paradigm. Amin Abdullah as the initiator of that scientific paradigm has divided the present science into three scientific discipline: religious studies (*hadlarah al-nash*), science (*hadlarah al-ilm*), and philosophy (*hadlarah al-falsafah*). This grouping leads to a realization that every area has its own limitation, hence encourages dialogue, collaboration and the use of methodology and approach from different scientific discipline (Amin Abdullah, 2006).

The scientific paradigm of integration-interconnection can be elaborated from two aspects, domain and model. Domain aspects are divided into four levels, namely the level of philosophy, material, strategy and methodology. There are six models that can be used to elaborate integration-interconnection paradigm: similarity, parallelize, complementation, comparisons and inductive models (Anonim, 2006).

Integration-interconnection learning approach is the implementation of scientific paradigm of integration-interconnection at strategy domain. The learning of general science (*hadlarah al-ilm*), including a mathematics, must involve and utilize

components and other elements found in the area of religious studies (*hadlarah al-nash*) and philosophy (*hadlarah al-falsafah*).

Similarity model means similarize concepts in science with concepts derived from religion, though the concept not necessarily the same. Parallelize model assumes that concepts from the qur'an parallel with concepts derived from science because of similarity in connotation, but without equating the two. Complementation model portrays that science and religion are co-exist and mutually reinforce each other, but still maintaining the existence of each. Comparison model compares scientific concept (theory) with the concept of religious insight the same symptoms. Inductive model means that the basic assumptions of scientific theories is supported by empirical findings, and the rationale is continued theoretically towards metaphysical thinking, then connected with related religious and *Al Qur'an* principles. Verification model study reveals that the results of scientific research support and prove the truths of verses in *Al Qur'an* (Anonim, 2006).

## 2.2 Clinical Supervision

Supervision can be viewed as an "art" of cooperation with a group of people, where they are subjected to an authority in such a way that work implementation lead to the highest possible results. This demands the ability to practice the principles of human relationships as well. There are no definite and convincing rules applied in human relationships, and every person has unique personality. Therefore, developing working relationships should always consider the personality of other (Nurtain, 1989 and Sri Banun Muslim, 2010).

The addition of clinical terms refers to the way doctor treats patient who suffering from pain. A clinical trial in health science is basically a series of new medicine development process. During the trial, a new type of medication or treatment is expected to give a better result compared to existing treatments (Edward White and Julie Winstanley, 2010). Regarding this issue, the doctor will try to communicate, and find a way to diagnose and provide professional and reliable services. Such a relationship also applied in clinical supervision between lecturers and supervisor. Supervisor will observe lecturer during learning activities to obtain information needed. Based on the recorded data or facts, supervisor and lecturer can collectively find a way to improve learning process (Suparwoto, 2006).According to Richard Weller and cited by Acheson and Gall, clinical supervision is defined as

a form of supervision that focus on teaching improvement through systematic cycles in planning, observation, and intellectual as well as intensive analysis about the real teaching performance that makes changes in a rational way (Sri Banun Muslim, 2010).

Based on the two definitions above, operational definition for clinical supervision is a supervision that aims to improve lecturers' professionalism intentionally (*by design*), started from initial meeting, final meeting and class observation, followed by careful, thorough and objective analysis to get expected behavior change in teaching. This clinical supervision is a form of professional help, conducted systematically based on lecturers needs, in the hope that lecturers can find a way to increase their teaching ability and skills.

Among the main characteristics of clinical supervision is that clinical supervision is a technique for improving learning quality, a deliberate intervention in the process of goal-oriented learning, which combining the school needs with the needs of lecturers' personal development, connecting gap between reality and ideal, as well as assume professional working relationships between lecturers and supervisor. In addition, clinical supervision requires a strong mutual trust as a reflection of understanding support and commitment to develop (Susan Sullivan and Jeffrey Glanz, 2005).

The procedure of supervision implementation that undertaken in the cycle of learning consists of three phases (Arham JF., 2014):
1. The first phase is performed at the beginning of activity, and emphasized to build familiarity, openness, equality, and collegial atmosphere. The main discussion should about how to improve the quality of lecturer profession. This initial meeting should produce an agreement between lecturers and supervisor about lesson plan and instrument for learning observation.
2. The Observation phase, lecturers implement the arranged lesson plans and supervisor records the facts that occurred during learning, using the agreed instrument.
3. The final phase (the meeting end) focus on feedback discussion (reflection) between lecturers and supervisors, soon after learning activity. This meeting is similar with the initial meeting, in which no rating activity (no good or bad judgment).

## 2.3 Research Development with Four-*D* Model

Developmental research is a research aimed to develop learning instruction. Model used in developing learning instruction is a four-D model. A four-D model consists of a define phase, design phase, develop phase and disseminate phase (Savasailam T., et al., 1974 and Ade GorbiI., et al., 2018). The description of each step is as follows:

1. The Define Phase
   a. Problem Identification
      The aim of define phase is to establish and define the needs in developing learning, through needs assessment that consider the existed initial conditions (concepts).
   b. Setting Analysis
      Things to note on background analysis is:
      1) Characteristics of college students
         The purpose of knowing students' characteristics is to measure initial knowledge, to identify things that hinder or support learning activities, as well as to determine learning strategies to achieve learning outcomes and competence indicator.
      2) Learning conditions
         According to Dunn (Harjanto, 1997), learning conditions that need to be disclosed is physical environment, emotional environment, sociological environment, and physiology of students.
      3) Relevant sources and devices
         Identification of sources or devices includes available (used) sources or devices, human or non-human, and sources or devices that either intentionally designed or utilized.
2. The Design Phase
   The purpose of this step is to devise a learning form that meet the needs and address the problems identified in the define phase.
3. The Develop phase
   The steps that must be undertaken on develop phase are:
   a. Identification of basic competencies and learning outcomes indicators
   b. Determining learning strategies
   c. Creating learning prototype
   The steps in this phase are included in the learning outline
4. Disseminate phase

After designing learning device at develop phase, the next phase is dissemination that consists of these steps:
a. Test device
b. Results analysis by triangulation.

## 3 IMPLEMENTATION OF THE INTEGRATION-INTERCONNECTION PARADIGM IN LEARNING MATHEMATICS

Learning activity in classroom, laboratory, or outside classroom is a complex lecturer-student activity. Learning activities are simultaneously revealing aspects of art, technology, science and the value option for anyone who choose lecturers profession. This profession includes expertise, responsibility, and collegial. The expertise is acquired through intensive and qualified education and training, responsibility relates to lecturer daily task in his profession, while the collegial is related to the relationships between fellow lecturers.

There are many parallel courses(a subject with the same nomenclature, code, and SAP, and held in several classes) at the Faculty of Science and Technology, UIN Sunan Kalijaga that taught by different lecturers. For each parallel course, a coordinator is selected through a faculty meeting and ratified through the Dean Decision Letter. The implementation of integration-interconnection learning at the Faculty of Science and Technology was observed in parallel courses, including Calculus I. The observations of learning implementation used a blue print that created by the research team and had been tested before (Khurul W., et al., 2007):

Table 1: Blue print of observation sheet.

| Level/Domain | MODEL | | | | | |
|---|---|---|---|---|---|---|
| | A. | B. | C. | D. | E. | F. |
| 1. | | | | | | |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | | | | | | |
| 1. Philosophical 2. Material 3. Methodology 4. Strategy | A. Similarity D. Comparison B. Parallelize E. Inductive C. Complementation F. Verification | | | | | |

The initial integration-interconnection learning model has been made, but the model is not final.

This is mainly due to the differences of in understanding aspects of integration-interconnection between observer (fellow lecturer), both on level and model aspect. For example, the implementation of integration-interconnection in class of Calculus I on derivative subject: the lecturer made an analogy between derivative concept and descendants (generation) because both subjects related to heredity. Lecturer quoted *Al Qur'an Surah Ali Imron,*9 and motivated students to carefully calculate derivative function, and then related it to the preparation of becoming a parent. From the observations, two observers argued that the integration-interconnection level used was philosophy and one observer was agreed on material. In addition, all observers had different opinions on the model used, between similarity, parallelize, or complementation.

Clinical supervision forms are required to eliminate the differences in observation results, since implementation of clinical supervision should refer to the standard of lecturer professional development that engaged expertise, responsibilities and collegial principles. Therefore, one of the recommendations resulted from this study is that implementing clinical supervision for improving integration-interconnection learning quality (particularly parallel courses in the Faculty of Science and Technology) needs an expert (as well as supervisor of integration-interconnection) to define every level and model of integration-interconnection operationally, for the subjects concerned. This supervision model can be elaborated through a developmental research using four-D model. The procedures and phases of clinical supervision that include 3 stages (the first stage, observation and the end) can be elaborated with 4 stages of four-D model(define, design, develop, and disseminate), as follows :

1. The first stage: the focus of initial meeting is an agreement between lecturers, supervisors and expert tutor (speaker), through the following steps:
   a. The speaker creates a familiar, open, and honest atmosphere between supervisor and lecturers to define (problem identification) and assess the needs. The need assessment is based on background analyses that consider students characteristics, learning conditions, as well as relevant sources and devices. This step is known as *define* in four-D model.
   b. All participants choose one model lecturer (other lecturers become supervisors) with the modeling focus is not how to teach, but how

student learns, including the deficiency and excess of lesson models.
   c. The speaker determines both integration-interconnection aspects, domains (level) and model, followed by dissemination to all lecturers.
   d. The model lecturer designs lesson plan that meet the assessed needs and address the identified problems, as well as determining plan for implementing integration-interconnection based learning. This step is the *design* phase of four-D model.
   e. The lecturers select and develop observational instruments collaboratively and cooperatively, especially learning observation instruments that focus on integration-interconnection aspects. This develop step consist of identification of basic competencies and learning outcomes, indicators of learning outcomes, determining learning strategies and creating learning prototype. All is included in the learning outline.
2. The observation stage: this stage includes the steps of learning implementation in a real classroom, which in detail is as follows:
   a. The model lecturer implements the lesson plan, the supervisor records all facts that occur during lesson with the instruments, and the speaker observe the process.
   b. The supervisors and speaker note the recorded facts systematically and clearly.
   c. The facts that occurred during learning are used as materials for guidance and direction.
3. The final stage: this stage is the evaluation and feedback discussion between model lecturer and supervisor, immediately after lesson, that consists of:
   a. Inquire the feeling of model lecturer about the learning implementation.
   b. Display the observation results that has been analyzed and interpreted by supervisors and speaker.
   c. The speaker gives improvement inputs to supervisor regarding to observation on integration-interconnection aspects.
   d. The speaker inquiries the response of model lecturer toward the observation results and input.
   e. The speaker asks model lecturer to explain the results of analysis process.
   f. Make a research report

# 4 CONCLUSIONS

Improving quality of education can be achieved through various means, among them is by giving opportunity to solve learning and non-learning problem professionally through clinical supervision and research development. The improvement is subjected to: 1) the ability to solve problems in education and learning contextually; 2) the quality of course content, inputs, processes and outcomes of learning; 3) lecturers' professionalism; and 4) the application of research-based learning principles.

Implementation steps of integration-interconnection learning with elaborated clinical supervision and developmental research is the first stage of four-D model. Clinical supervision in the observation stage is the dissemination stage, and the final stage equivalents to evaluation activities. A very important thing to note is that the evaluation stage should not include judgement (good or bad) or rating toward lecturer. Also, the speaker gives inputs to supervisor regarding to observing integration-interconnection aspect in learning. After all the three stages ends, research results must be communicated through a report for self-reflection as well as a scientific resource for fellow lecturers, educational officials and others.

In implementation integration-interconnection learning at the Faculty of Science and Technology through clinical supervision, the role of integration-interconnection expert is crucial. Otherwise, we need to implement a collaborative clinical supervision and research development with lecturers of Islamic studies.

# ACKNOWLEDGEMENTS

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