

Validity of Investigation Based Scientific Collaborative (IBSC) Learning Model To Facilitate Students' Communication and Collaboration Skills

1st Peni Suharti

Department of Biology
Universitas Muhammadiyah Surabaya
Surabaya, Indonesia
Peni.fkipumsby@gmail.com

2nd Muslimin Ibrahim

Department of Biology
Universitas Negeri Surabaya
Surabaya, Indonesia
musliminibrahim@unesa.ac.id

3rd Yuni Sri Rahayu

Department of Biology
Universitas Negeri Surabaya
Surabaya, Indonesia
yunirahayu@unesa.ac.id

Abstract— Communication and collaboration are skills that needed in the 21st century, and also including as one of the science process skills and generic skills that students must possess. This development research aims to 1) develop an Investigation Based Scientific Collaborative (IBSC) learning model to facilitate students' communication and collaboration skills with the occurrence positive dependency among students, and 2) to describe the validity of the developed IBSC learning model. The Type of research is Research and Development (R&D). The object of research is IBSC Learning Model. IBSC learning model was developed by Borg & Gall design, consist of three stages, namely the preliminary, product development and produk trials. In this paper only discusses the validity of the results of product development result, namely the IBSC learning model. Validation of IBSC learning model was carried out by three experts using a validation sheet instrument based on the opinion of Joyce & Wiel and Nieveen. The results reveals that the IBSC model has five syntaxes namely 1) Motivation and Problem Orientation, 2) Collaborative Investigation on Sharing Tasks, 3) Presentation, 4) Collaborative Investigation on Jumping Tasks, and 5) Evaluation. Based on the validation results, it was obtained that the category mode for construct and content validity were in very valid criteria. This results showed that the IBSC learning model was valid to facilitate students' communication and collaboration skills, which means the IBSC learning model can be implemented.

Keywords— communication skills, collaboration skills, collaborative learning, positive dependency, jumping tasks, sharing tasks

I. INTRODUCTION

Communication and collaboration are skills that must be developed in students. Both of these are 21st century skills, science process skills and generic skills [1]; [2]; [3]; [4]. Communication and collaboration skills are aspects that determine a person's successful. Based on the results of a survey in America conducted by the National Association of Colleges and Employees [5] that the most important indicators of a champion collaboration skills, integrity, communication, and ethics. Based on Harvard University' research, it was report that 80% of a person's success is determined by the person's soft skills in managing themselves and others, while 20% of a person's success is hard skills such as technical skills and knowledge.

Based on these explanation, communication and collaboration are important things to developed in students, but both of these skills were no mastered by Indonesian students yet. Indonesian students' science skills are still at the level of recognizing of some basic facts [2]. Based on the

results of research that conducted at 5 Muhammadiyah High Schools in Surabaya, it was found that students' communication skills were in the low category with a value of 47%, as well as for students' collaboration skills, were in the low category with a value of 51.14%.

The observation results of the lesson plan made by the teacher have not found any step of learning that intentionally (by design) facilitates the occurrence of positive dependency among students that can encourage students to communicate and collaborate, and there is no teacher's step that can facilitate the occurrence of positive dependency among students.

The lack of students' communication and collaboration skills occurs because teachers have not intentionally fostered positive dependencies among students in carrying out learning that will encourage students to communicate and collaborate that can train and develop students' communication and collaboration skills. In addition, from the existing learning model there are no steps that intentionally facilitate the occurrence of positive interdependence among students which will encourage students to communicate and collaborate [6]; [7]; [8].

Based on the background above, then conducted the development study to develop Investigation Based Investigation Based Scientific Collaboration (IBSC) learning model to facilitate students' communication and collaboration skills. After IBSC learning model was developed, the validity test must be conducted before IBSC implemented in the learning process.

The IBSC model is designed to train students' communication and collaboration skills, especially in the collaborative investigation on sharing task phase and the collaborative investigation on jumping tasks Phase, as well as maximizing the role of the teacher as a mediator and facilitator in both phases to facilitate the occurrence of positive dependencies that will encourage communication and collaboration in between students, so they can train students' communication and collaboration skills in learning.

II. METHODS

The development of the IBSC model refers to the Research and Development design according to Borg and Gall [9]. Broadly speaking, the development steps consist of 3 main steps but for the research development it only includes 2 steps, namely, 1) a preliminary study, including literature studies and field surveys to observe existing products and activities, to identify problems and identify the characteristics of

educational products that developed and 2) product development includes product preparation, and product validation. The development model steps by Borg and Gall were modified according to the needs, objectives and conditions on the field.

The purpose of the preliminary study was to describe and analyze the problem to develop a biology learning model that have positive effect to facilitate students' communication and collaboration skills. The focus of preliminary study was to gather as much information as possible through library research, consultation and direct observation [10]. This preliminary study was conducted to identify problems, identify the characteristics of the product to be developed, then the results were analyzed and described so that it can be used as a reference in product development. After the preliminary study was done, then it followed with product development. The first product development was in the form of a product draft as prototype 1. Prototype 1 was Investigation Based on Scientific Collaboration (IBSC) learning model to facilitate students' communication and collaboration skills.

After the IBSC learning model was developed then followed by expert validation. The validity test was conducted to validate the product draft (prototype I) of the learning model and the product draft (prototype I) of the learning device. According to Joyce and Weil, Good Learning Models must have five criteria, namely 1) syntax, 2) social systems, 3) reaction principles, 4) support systems and 5) instructional impact [18]. According Nieveen, the validity of learning model consist of content validity and construct validity. Content validity consist of six criteria namely 1) Learning model development need, 2) state of the art of knowledge, 3) theoretical support of learning model, 4) Learning model planning, 5) management of the learning environment, 6) use of the latest evaluation techniques. The construct validity consist of six criteria to, namely 1) learning model structure, 2) theoretical and empirical support, 3) implementation of the learning model, 4) management of the learning environment, 5) use of evaluation techniques, and 6) Learning model : a final thought [21]. The validation results were used as a reference for revising the IBSC model product so that a valid product was produced based on expert judgment, which then referred to prototype II as a tentative product. Validation data were analyzed descriptively quantitative. Validation data were analyzed descriptively kuantitatif based on the validity criteria of Arikunto [22] as follows.

TABEL 1. VALIDITY CRITERIA OF LEARNING MODEL

Interval Skor	Kriteria penilaian
3,25 < P ≤ 4,00	Very Valid
2,50 < P ≤ 3,25	Valid
1,75 < P ≤ 2,50	Low Valid
1,00 < P ≤ 1,75	

Not Valid

III. RESULTS

A. Results of Learning Model Development

The syntax of IBSC learning model was developed based on the characteristics of collaborative learning, a study of the implementation of the Jigsaw learning model and the Group Investigation of the sharing task theory and jumping tasks. The IBSC model syntax was developed with 5 phase including 1) Motivation and problem orientation, 2) Collaborative Investigation Sharing Task, 3) Presentation, 4) Jumping Investigation Task, 5) Evaluation. The emergence of IBSC learning syntax was according to theoretical and empirical arguments as presented in Table I.

The characteristics of the Investigation Learning model based on Scientific Collaboration (IBSC) emphasize the CTL and scientific approach. The types of knowledge that can be accommodate by the IBSC model are factual, conceptual, procedural, and metacognitive knowledge. Special features in the Investigation Based Scientific Collaborative model are 1) positive interdependence, 2) collaborative sharing tasks and jumping tasks 3) strategies for facilitating communication and collaborative skills, 4) characteristics of biological material that can be taught using the IBSC model is the biological material based on multi representations (verbal, visual, and mathematical), that could be conceptual or experimental understanding.

Problems characteristic used in Sharing Task and Jumping Task activities can be phased from academic problems to authentic problems. This depends on the skills and provisions that students have.

B. Validation of the IBSC Learning Model to Facilitate Students' Communication and Collaboration Skills

The Investigation Based on Scientific Collaboration (IBSC) learning model was arranged in the form of a model book. The IBSC learning model was reviewed by experts to determine the validation of the learning model. Validity criterias are (1) according to the needs, (2) is up-to-date, (3) has a strong theoretical and empirical foundation, and (4) there is consistency between the components of the model [18].

The hypothetical IBSC model developed was validated by 3 experts before being tested both content and construct. Content validity describes the needs and the up-to-date (state of the art). While construct validity describes the consistency between the IBSC model with supporting theories and the consistency between components [18].

Validation was carried out on 2-10 May 2019 by three experts. The three experts validated the IBSC model book using the validation sheet instrument. Based on the suggestions of the validators, the IBSC learning model will be revised.

TABLE 2. THEORITICAL AND EMPIRICAL SUPPORTS OF IBSC MODEL LEARNING' SYNTAX

No	Syntax of IBSC Learning Model	Theoretical and Empirical Supports
1	Phase I Motivation and Orientation	<ul style="list-style-type: none"> The initial phase is important to motivate the students [7] Theory of Motivation, Presenting facts / phenomena / problems that will motivate the students Students will learn well if what they are learned is related to what they are already known either the activities or events that occur around them [11] Motivation provides a successful effect [12] Phase I of jigsaw model' syntax that is explaining goals, this phase will give students direction about what must be understood [7]
2	Phase II Collaborative Investigation Sharing Tasks	<ul style="list-style-type: none"> Positive dependence occurs because there is empathy and courage of students. This positive dependence will stimulate students to interact with others [6] Heterogeneous groups to facilitate students to collaborate Vygotsky's theory of sharing perspectives to build mutual understanding [7]; [13] Bandura's social learning theory where learning is the result of imitating an expert model; Communication and collaboration increase motivation [12] Sharing tasks, strategies to facilitate collaboration according to curriculum competency demands [6]; [8]; [14]; [15]; [16] The syntax III of the GI (Investigation) model shows that sharing activities are dominated by smart students and the teacher acts as a mediator and facilitator Cognitive theory, social constructivist theory, ZPD Theory [7]
3	Phase III Presentation	<ul style="list-style-type: none"> Positive dependence occurs because there is empathy and courage of students and then the positive dependence will stimulate the students to interact with others [6] Bandura's social learning theory where learning is the result of imitating an expert model; Communication and collaboration increase motivation [12] Cognitive theory [7] Social constructivist theory [7] Cognitive constructivist processing level theory [7] Research results [17] The teacher as a mediator and facilitator
4	Fase IV Investigasi Kolaboratif Jumping Task	<ul style="list-style-type: none"> Positive dependence occurs because there is empathy and courage of students. This positive dependence will stimulate students to interact with others [6] Heterogeneous groups to facilitate students to collaborate Vygotsky's theory of sharing perspectives to build mutual understanding [7]; [13] Bandura's social learning theory where learning is the result of imitating an expert model; Communication and collaboration increase motivation [12] The syntax III of the GI (Investigation) model shows that sharing activities are dominated by smart students and the teacher acts as a mediator and facilitator Cognitive theory, social constructivist theory, ZPD Theory [7] Positive Transfer Theory [13]; Jumping task theory [8] Jayanti and colleagues research results [15]. Jumping Task is a leap task to facilitate high-ability students
5	Phase V Evaluation	<ul style="list-style-type: none"> Recent effect theory [7] Evaluation is done after the learning process, placed at the end Feed Back is important to increase motivation Giving rewards based on performance and good behavior [7]

TABLE 3. RESULTS OF CONTENT VALIDITY OF IBSC MODEL LEARNING

No	Category of IBSC Model Learning	Average of Validity Score	Validity	R*	Reliability
1	IBSC Learning Model Development Needs	4	Very Valid	100%	Reliable
2	State of the art of knowledge	4	Very Valid	100%	Reliable
3	Theoretical Supports of IBSC Learning Model	4	Very Valid	100%	Reliable
4	IBSC Planning	4	Very Valid	100%	Reliable
5	Management of the Learning Environment	4	Very Valid	100%	Reliable
6	Use of the Latest Evaluation Techniques	4	Very Valid	100%	Reliable
	Mode	4	Very Valid	100%	Reliable

R = Percentage of agreement (Reliability coefficient)

1) *Results of Construct Validity of IBSC Learning Model*

The results of the construct validity of the IBSC model were shown in Table III.

IV. DISCUSSIONS

The results of the validation of the learning model as in Table II and Table III showed that the content validity and construct validity of the IBSC model are very valid. The statement based on mode category of validity data in all aspect of the content validity and contruk validity are very valid. The results of the IBSC model validation both the contents validity and the construct validity are in accordance with the validity criteria of Nieveen and his colleagues [18] and also accordance with the validity criteria of Plomp and Nieveen [19] that the learning model has content validity and construct validity in valid criteria, so that it can be declared feasible as an educational research product.

Content validity was declared very valid based on Table II means that IBSC learning model that has been developed was needed for students' development and this learning model was also designed based latest trend, while the construct validity that was declared valid based on Table III means the quality of the IBSC model was good and there was consistency between parts of the model developed with the underlying theory.

A. *Content Validity of IBSC Learning Model*

The content validity of the IBSC model was declared valid based on the needs and state of the art. This is in accordance with Minister of Research and Technology Regulations No. 44, 2015 [20] which generally emphasizes that innovation and novelty in doctoral research that must use a trans disciplinary approach that is expected to solve problems and create new understanding through the integration of various disciplines including studies in psychology, natural sciences, biology and education. Innovation and novelty aspects can be seen from the needs and novelty of the IBSC model in terms of: 1) The novelty of the IBSC model compared to other models that have been used to train students' communication and collaboration skills, namely the Jigsaw model and the Group Investigation (GI) model, 2) The role of the IBSC model in training 21st century skills, namely communication and collaboration skills and others 3) The role of the IBSC model in the implementation of the 2013 Curriculum.

B. *Construct Validity of IBSC Learning Model*

The construct validity of the IBSC model was determined based on 1) consistency between phases in the syntax of the model, 2) consistency between the components of the model, and 3) consistency of the model with the underlying theory. Based on the results of construct validity review on Table III, it was declared that IBSC learning model was valid.

1) *Consistency Between Phases In The Syntax of The IBSC Learning Model*

The IBSC learning model has shown consistency between phases in the syntax of IBSC learning model. The syntax of

the IBSC model consists of five phases, namely 1) motivation and problem orientation, 2) collaborative investigation of sharing tasks, 3) presenting, 4) collaborative jumping task investment, and 5) evaluation. The five phases have been designed to be interconnected with one and another.

2) *Consistency Between The Components of The IBSC Learning Model*

The IBSC model had shown consistency between the components of the model which includes the syntax of the model, social systems, reaction principles, support systems, as well as instructional and accompaniment impacts. This can be seen in student-centered learning activities, and the teacher's role as a mediator, facilitator, and guide. The support system in the form of learning devices, learning resources, students' psychological conditions, learning environment and the ability of teachers to manage learning were expected to be able to support the implementation of the IBSC learning model. Thus it can support the achievement of instructional goals that have been set in accordance with the findings of Arends [11] that all the patterns contained in the learning model are able to lead to the achievement of affective, cognitive, and psychomotor learning outcomes including those which are the main objectives of the IBSC model that are to train students' communication and collaboration skills.

3) *Consistency of The Model With The Underlying Theory*

The IBSC learning model had also shown consistency between the model and the underlying theories. Some theories that have been used as the foundation of the IBSC model were 1) positive dependency theory, 2) cognitive constructivist theory and social constructivist theory, 3) cognitive learning theory, 4) Bandura' social learning theory, and 5) motivation theory [13]; [11]; [7]. The IBSC learning model was already designed so as to be able to train students' collaborative skills which are facilitated by the teacher through his role as moderator and facilitator.

IBSC was valid based on the consistency of IBSC with underlying theory. Based on the results of Table II and Table III, IBSC was feasible to be called as learning model. Arends stated that learning models differ from strategies or methods because they have a clear theoretical foundation so that the learning model can describe what students are learning and how students learn, as well as describe how the behavior of teachers and students [11].

Based on the results of Table I, Table II, and Table III, it was shown that IBSC learning model was very valid based on content validity and construct validity. IBSC learning model that was developed was already designed based on theoretical foundation to facilitate students' communication and collaboration skills. Based those validity results, IBSC learning model was feasible to be tested in classroom.

V. CONCLUSIONS

Based on the results and discussions that was already done, it can be formulated some of the conclusions such as followed:

- The IBSC learning model was developed to facilitate students' communication and collaboration skills with 5 syntax, namely 1) Motivation and problem orientation, 2) Collaborative Investigation of Sharing Tasks, 3)

- Presentation, 4) Investigation of Jumping Task, 5) Evaluation
- The validity of the developed IBSC learning model has a very valid category both for content and construct validity which means the IBSC learning model can be implemented.

REFERENCES

- [1] Partnership 21st century Skill. *21st Century Knowledge and Skill in Educator Preparation*, AACTE. 2010.
- [2] NRC. *Assessing 21st Century Skills: Summary of a Workshop*. J.A. Koenig, Rapporteur. Committee on the Assessment of 21st Century Skills. Board on Testing and Assessment, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press. 2011.
- [3] Care, E. and Griffin, P., Scoular, C., Awwal, N., Zoanetti, N. *Collaborative problem solving tasks*. In P. Griffin & E. Care (Eds.), *Assessment and teaching of 21st century skills: Methods and approach*. Dordrecht: Springer. 2015.
- [4] Yeung, A.S., Ng, Chistina, Liu, W.P. *Generic Cavabilities for Life Long Education: Conceptualization and Construct Validity*, Australian Association for Reasearch and education, Fremantle, 2015. Tersedia di <http://aarc.edu.au>.
- [5] NACE. Retrieved Desember 27, (2016). From National association of Colleges and Employers. 2015. <http://www.nacweb.org>.
- [6] Sato, Masaki. *Dialog dan Kolaborasi di Sekolah Menengah pertama, Praktek learning Community, Kerjasama Depdiknas, Depag dan Jica*. 2011.
- [7] Slavin, E. R. *Educational psychology. theory and practice*. Boston: Pearson. 2011.
- [8] Sato, Manabu. *Mereformasi Sekolah: Kosep dan Praktek Komunitas Belajar. Edisi Indonesia*. Tokyo: The International Development Centre of Japan Inc. 2014.
- [9] Borg and Gall. *Education Research*. New York : Allyn and Bacon. 2003.
- [10] Suharsimi, A. *Prosedur Penelitian Suatu Pendekatan Pratik*. Jakarta: Rineka Cipta. 2006.
- [11] Arends, R. I. *Learning to teach; 9th edition*. New York: Mc. Graw – Hill Companies, Inc. 2012.
- [12] OECD. *Collaborative problem solving framework*. OECD Publishing. 2013.
- [13] Moreno, R. *Educational psychology*. New York: Jhon Wiley & Sonc, Inc. 2010.
- [14] Sato, Manabu. *Reformasi Sekolah dengan Learning Community: Visi, Filosofi, dan Sistem Kegiatan*. Makalah ITTEP-Japan: JICA. 2016.
- [15] Jayanti, E., Supriatna, Komalia, Kurnia. *Sharing and jumping Task Based Lesson Design of Conservation of mass Concept*. *Proceeding International Conference of Lesson Study (ICLS)7th* University of Muhammadiyah Malang Indonesia 3-5 November 2016. p. 62-66.
- [16] Keller, M. J. *Motivational design for learning and performance the ARCS model approach*. USA: Springer. 2010.
- [17] Kapur, M. *Productive failure*. *Cognition and Instruction*, 26 (3), 2008. 379-42
- [18] Nieveen, N Mc. Kenney, S., Van D. Akker. *Educational Design research dalam Educational Design Research*. New York: Routledge. 2007.
- [19] Plomp, T. & Nieveen, N. *Introduction to the collection of illustrative cases of educational design research*. In T. Plomp, & N. Nieveen (Eds.), *Educational design research – Part B: Illustrative cases* (pp. V-XX). Enschede, the Netherlands: SLO. 2013.
- [20] Permenristek Dikti No. 44 Tahun 2015.
- [21] Joyce, B. & Weil, M. *Models of teaching (8th ed.)*. New Delhi: Prentice Hall of India. 2007.
- [22] Arikunto, Suharsimi. *Prosedur Penelitian Suatu Pendekatan Pratik*, Yogyakarta: Rineka Cipta. 2010.