

MODERN INSTRUCTIONAL DESIGN

by M. Haviz

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MODERN INSTRUCTIONAL DESIGN ON EDUCATIONAL RESEARCH: HOW TO USE THE ADAPTIVE SYSTEMS ON INSTRUCTIONAL OF BIOLOGY

M. Haviz

Education Technology Laboratory of Natural Sciences STAIN Batusangkar,
West Sumatra Indonesia. Jalan Sudirman No. 137 Kuburajo Lima Kaum
Batusangkar West Sumatra Indonesia. Email: *haviz80@yahoo.co.id*

ABSTRACT

The research objective is to obtain a product in the form of instructional biology education research methodology using the principles of adaptive instructional system that is valid and practical. This research uses design Plomp, has four stages preliminary research, prototyping phase, the assessment phase and systematic reflection and documentation. The primary data were obtained from validation and observation sheets and interview guide. The secondary data were obtained from the academic unit. The qualitative data were analyzed with a step reduction, data presentation and conclusion. The quantitative data were analyzed with descriptive statistics. The results of preliminary research found any problem on learning, are (a) the learning process is not characterized by a national qualifications framework of Indonesia, and it's not in accordance with the vision of the institution and the characteristics of student. The results of prototyping stage is valid with the construction of a prototype rated load 9 main competencies, 14 supporting competency and supported by 8 concepts. The results of the assessment phase is a practical prototype on cognitive aspects, less practical on aspects of skills and attitudes. The use of adaptive instructional learning system is one way in finding a solution to the problem of student learning. Thus concluded that it had acquired modern instructional based adaptive instructional valid and practical. The resistance to the revision of the products that have been produced needs to be done by aligning syntax with the actual, use an external expert review, and the practicalities of a broader test.

Key words; modern instructional, educational research of biology, adaptive instructional systems

1. INTRODUCTION

Universities and colleges are required to apply the learning achievements of general and specific learning outcomes in accordance with the characteristic of the college outcomes. The aim is to equip graduates with the particular competence in accordance with Indonesian qualification frameworks. National Qualifications Framework Indonesian higher education is a framework level qualifications that can reconcile, equalize, and integrate the achievements of the learning of the path of non-formal education, informal education, and / or work experience in the types and levels of higher education [1]. The achievements of general learning, achievement of learning level 6 (bachelor/diploma 4) and learning achievement level 7 (the teaching profession). The full quote is as follows.

Capaian pembelajaran umum afeksi dalam Kerangka Kualifikasi Nasional Indonesia, sesuai dengan ideologi negara dan budaya Bangsa Indonesia, maka implementasi sistem pendidikan nasional dan sistem pelatihan kerja yang dilakukan di Indonesia pada setiap level kualifikasi mencakup proses yang menumbuhkembangkan afeksi sebagai berikut (a) bertaqwa kepada Tuhan Yang Maha Esa; (b) memiliki moral, etika dan kepribadian yang baik di dalam menyelesaikan tugasnya; (c) berperan sebagai warga negara yang bangga dan cinta tanah air serta mendukung perdamaian dunia; (d) mampu bekerja sama dan memiliki kepekaan sosial dan kepedulian yang tinggi terhadap masyarakat dan lingkungannya; (e) menghargai keanekaragaman budaya, pandangan, kepercayaan, dan agama serta pendapat/temuan orisinal orang lain; (f) menjunjung tinggi penegakan hukum serta memiliki semangat untuk mendahulukan kepentingan bangsa serta masyarakat luas. Capaian pembelajaran level 6 (sarjana/diploma 4) adalah (a) mampu mengaplikasikan

bidang keahliannya dan memanfaatkan ilmu pengetahuan dan teknologi pada bidangnya dalam penyelesaian masalah serta mampu beradaptasi terhadap situasi yang dihadapi; (b) menguasai konsep teoritis bidang pengetahuan tertentu secara umum dan konsep teoritis bagian khusus dalam bidang pengetahuan tersebut secara mendalam, serta mampu memformulasikan penyelesaian masalah prosedural; (c) mampu mengambil keputusan yang tepat berdasarkan analisis informasi dan data, dan mampu memberikan petunjuk dalam memilih berbagai alternatif solusi secara mandiri dan kelompok; (d) bertanggung jawab pada pekerjaan sendiri dan dapat diberi tanggung jawab atas pencapaian hasil kerja organisasi. Capaian pembelajaran level 7 (profesi guru) adalah (a) mampu merencanakan dan mengelola sumberdaya di bawah tanggung jawabnya, dan mengevaluasi secara komprehensif kerjanya dengan memanfaatkan ilmu pengetahuan dan teknologi untuk menghasilkan langkah-langkah pengembangan strategis organisasi; (b) mampu memecahkan permasalahan sains, teknologi, dan atau seni di dalam bidang keilmuannya melalui pendekatan monodisipliner; (c) mampu melakukan riset dan mengambil keputusan strategis dengan akuntabilitas dan tanggung jawab penuh atas semua aspek yang berada di bawah tanggung jawab bidang keahliannya. [2].

This mastery of competencies requires learning system changes. Changes in learning systems require educators to revise instructional design for each course that will be taught to students. This instructional design revisions require certain ways. Activities undertaken to revise instructional design called adaptive instructional system. The adaptive instructional system will be a reference for educators to make intervention necessary for individual learners and can increase their knowledge and skills [3, p. 651]

The instructional design should be revised and modern. This revised will be conducted to achieve modern frameworks that have been written in documents of the Indonesia framework qualification. The modern instructional models is a systematic process of building the instructional system that is effective and efficient, conducted by educators, teachers, lecturers and trainers or referred by teachers or staff who work specifically as an instructional designer in educational institutions [4, p. 2]. Integrative instruction is one form of learning and part of the modern instructional. Many integrative instruction identifiers to be part of modern instructional design. The characteristics of integrative instruction as part of modern instructional design have been reported by [5]; [6]; [7]. Many other research reports that support this opinion, e.g. research reports [8]; [9] and reviews on aspects that are relevant to this study [10]. There are several reviews of aspects of integration published on Educational Technology Research and Development. There are five aspects related to this study are (a) the design aspects of development; (b) aspects of the use of the concept of the model; (c) aspects of the evaluation of the model, including the use of test validity; (d) aspects of integration; and (e) the development aspects of developmental biology [6]. The reports of these studies is the result of research [11]; [12]; [13] and [14]. The fourth research report describes the integration of methods, strategies and learning materials. For example integrating the two approaches, namely objectivist and constructivist learning in instructional design [14]. The relationships fourth of this research with the development of integrated learning model in developmental biology is to be the integration of several methods and learning materials.

There are many of the problems discovered at the research methodology on biology education. Beginning with the unavailability of adequate learning resources to incompetence and ignorance of students as learners in learning. I have made the initial observation by means of direct discussions with students Tadris Biology STAIN Batusangkar. The topic of discussion was about the difficulties and obstacles they find in college. These constraints are learning resources are less available, the lack of provision of early learning students, the learning method that is applied is less appropriate, the diversity of students' ability, lack of clear instructional use by teachers, curriculum applied not hit a 6 and/or 7 in the framework Indonesia framework qualification, there is no lack of understanding of information technology, no / less understand the techniques of scientific writing, the learning styles of students tend to be relaxed and seemed lazy, instructional media are used not according to the characteristics of learning, courses shortage lecturers primary, student trouble to consult the lecturers because lecturers rarely present on campus and/or busy with other activities, the supervisor lesser role in guiding proposals, lack of

availability of local seminars and difficult proposal permits the study.

Based on the explanation needs to be done research on modern instructional design in biology education research methods. The research question is (a) how to shape the design and construction of modern instructional design methodology biology education research? (b) how the shape the validity and practicality instructional design methodology biology education research? The general objective of this study was to obtain product instructional design methodology of educational research in biology. Specific objectives of this study were (a) to describe the shape of the design and construction of modern instructional products biology education research methodology and (b) to describe the quality (validity and practicalities) product instructional design modern biology education research methodology.

2. METHOD

I used design research. This method has four stages, preliminary research; prototyping stage, assessment phase and systematic reflection and documentation [15, pp. 25-26]. The preliminary research, the researchers conducted a thorough analysis of the material and the problems associated with a framework based on literature review. At the prototyping stage, the researchers designed the initial reference framework and develop prototypes. This activity is cyclical, and can be divided into three forms, namely design, formative evaluation, and revision. At the assessment phase, researchers conducted in-depth exploration and assessment of the effectiveness of the prototype using summative evaluation. At the systematic reflection and documentation, researchers conducted a systematic documentation of activities after the completion of the prototype (systematic documentation) and conduct in-depth studies to give new theories or principles that contribute to the scientific (systematic reflection). The participants are researchers who also acts as validator, practitioners and observers. Students of Tadris Biology STAIN Batusangkar was at grade three, which amounted to 61 people. The primary data were obtained from the data validation and observation sheets and interview guide. The secondary data were obtained from the academic unit. The qualitative data was analysis was a step reduction, the data presentation and conclusion. The quantitative data were analysis with descriptive statistics [16, p. 337].

3. RESULT

3.1. Preliminary research

The analysis of the instructional needs of the work carried out by researchers on the identification of gaps of learning, gap analysis and the cause of the current state gap with the state should be. After the interviews were conducted, researchers found (a) learning resources are less available; (b) the lack of

provision of early learning students (c) applied learning methods are less appropriate; (d) the ability of student diversity; (e) the lack of clarity instructional use by teachers; (f) curriculum is applied not hit a 6 and/or 7 in Indonesian Qualification Frameworks; (g) the learning styles of students tend to be relaxed and seemed lazy; (h) study program deficiencies main supervisor; (i) the difficulty of students to consult the lecturers as lecturers rarely attended college, and / or busy with other activities.

Furthermore, researchers identify about the state of learning that should be implemented. Based on the identification is done, the state should be first, learning in higher education is required to apply the Indonesian Qualification Frameworks. Indonesian Qualification Frameworks based learning requires students to master a certain level of competence. Second, the learning process in STAIN Batusangkar must be in accordance with the vision of college, namely the integration. Third, students are able to understand the concepts and be able to write research proposals and research reports in the field of education.

Researchers have been analyzing general instructional purposes. The main competence subjects is students are able to understand the concept of research as well as being able to write a research proposal in the field of biology education. Student behavior and baseline characteristics obtained by identifying the origin of school and college students majoring in high school / equivalent. This data was obtained from secondary data [17]. The research findings show that the average student in Senior High School was 52.46%, the students who enroll in *Madrasah Aliyah* was 44.26% and vocational school students was 3.28%. Students from majoring in science is 75.40%, students are majoring in social studies is 13.11%, language majors is 8.19%, and others 3.30%.

The findings in the literature review are (a) models of teaching [18]; (b) behaviorism, cognitivism, constructivism: comparing the critical features from instructional design perspective [19]; (c) modern instructional models [4]; (d) integrative learning of model, [20]; (e) Indonesian qualification frameworks [21]; (f) curriculum based competence at university [22]; (g) design research [15]; (h) adaptive instructional system [3]; (i) learning materials [23]. So that the instructional needs analysis findings can be concluded (a) the results of the analysis showed that the instructional needs of the learning process should be characterized by applying the national qualifications framework based learning Indonesia, in accordance with the vision of the institution and the student is able to understand the concepts and be able to write research proposals and research reports in the field of education; (b) the results of the initial analysis of the behavior and characteristics of the students showed that students have diverse characteristics and (c) the existence of a problem that causes gaps in

learning research methods. These initial findings will be used as the primary reason in modern instructional design.

3.2. Prototyping stage

At the prototyping stage, I designed the initial reference framework and develop prototypes. This activity is cyclical, and can be divided into three forms, design, formative evaluation, and revision. Design activities consist of activities designed the prototype construction and design prototypes. Formative evaluation conducted by validity. Based on the findings of two previous activities carried out revision of the prototype.

3.2.1. Design prototype

The prototype has been designed is matrix construction design and written in Tables 1 and 2, instructional analysis, planning for learning, and learning outcomes assessment tool. Results of the analysis show the instructional core competencies expected and or be achieved after the learning process is a biology education research

"mahasiswa mampu memahami konsep penelitian serta mampu menulis proposal dan laporan penelitian di bidang pendidikan"

To support achievement of the key competencies required support of nine competence is

(a) mahasiswa mampu menjelaskan hubungan filsafat, penelitian dan pendidikan; (b) mahasiswa mampu menjelaskan konsep dasar penelitian pendidikan; (c) mahasiswa mampu menemukan dan menyeleksi topik penelitian; (d) mahasiswa mampu membuat rancangan penelitian (research plans); (e) mahasiswa mampu menjelaskan cara menyeleksi sampel penelitian; (f) mahasiswa mampu merancang instrumen penelitian; (g) mahasiswa mampu memahami, memilih dan melakukan penelitian terpilih dari penelitian deskriptif (descriptive research), penelitian korelasi (correlational research, penelitian komparasi-kausal (causal-comparative research), penelitian eksperimen, penelitian subjek-sendiri (single-subject experiment) dan penelitian pengembangan (design research / research and development; (h) mahasiswa mampu menganalisis dan menginterpretasikan data hasil penelitian dengan statistika deskriptif dan statistika inferensia; dan (i) mahasiswa mampu menulis proposal dan laporan penelitian.

Syllabus is a more complete description of the instructional analysis. In the syllabus has been designed this subject written components, and sub-subject, learning and learning resources. Learning outcomes assessment tool is divided into two parts, namely cognitive assessment tools to measure student and an assessment tool to measure skills and attitudes. The instrument used to measure cognitive students in the form of a written test. The aim is to measure the level of mastery of the basic concepts of educational research carried out after the learning process. The instrument used to measure the skills and attitudes of students in the form of observation sheet. The aim is to measure the level of mastery of the skills and attitudes that emerged during and after the learning process implemented. Findings design phase concluded (a) the construction design of the prototype demonstrates that there are nine core competencies 9

and 14 supporting competencies that must be mastered by the student; and (b) the construction of the

prototype design has 8 theories and concepts used in the design.

Table 1 Matrix of modern instructional design on biology educational research

No	Design Research (Plomp, 2010)	Construction of Model [18]					Integrative Instruction (Haviz, 2012b)
		Syntax	Principle of reaction	Social System	Supporting system	Instructional effect	
1	Preliminary Research	Characteristic of institution	•	•	•	•	•
		Characteristic of students	•	•	•	•	•
		Characteristic of instructional	•	•	•	•	•
2	Prototype Stage	Design prototype	•	•	•	•	•
		Formative evaluation	•	•	•	•	•
		Revision	•	•	•	•	•
3	Assesment Stage	Summatif evaluation	•	•	•	•	•
4	Documentation and Reflection of Systematic		•	•	•	•	•
			•	•	•	•	•

Note: Abb (•) show the component on matrix

Table 1 Matrix of modern instructional design on biology educational research

No	Design Research [15]	Model Instructional Modern [4]	Behaviorisme, Cognitivism, Constructivism [19]	IFQ [21]	KBK-PT [22]	Adaptive Instructional System [3]	Material of Research [23]
1	Preliminary Research	Characteristic of institution		•	•		
		Characteristic of students		•		•	•
		Characteristic of instructional	•	•	•	•	•
2	Prototype Stage	Design prototype	•	•	•	•	•
		Formative evaluation	•	•	•	•	•
		Revision	•	•	•	•	•
3	Asesment Stage	Summative evaluation	•	•	•	•	•
4	Documentation and Reflection of Systematic		•	•	•	•	•
			•	•	•	•	•

Note: Abb (•) show the component on matrix

3.2.2. Formative evaluation

Formative evaluation is done to test the validity of the prototype. Based on the findings of the theory, written aspects of assessment of learning models, design research, integrative learning, learning theory, the instructional design modern, the curriculum based competence with Indonesian qualification frameworks, adaptive instructional system, and language learning material. The result of validity test are written in Table 3.

3.3. Assesment stage

At the assessment phase, I was conducted in-depth assessment of the practicality of the prototype using summative evaluation. Summative evaluation results include the results of cognitive learning, skills and attitudes. Thirdly the data is written in Tables 4, 5 and 6. The results are based on cognitive learning of students about the concepts and theories about educational research. Learning outcomes and skills and attitudes based on observed when students conducting thesis students in to review earlier, writing summaries and write a plan proposal, find articles, article feasibility, understanding the article, and the quality of the study article.

Table 3 Results of the validation prototype

No	Aspects	Indicators	Result of validation			
			No Valid ($\chi \pm$ STDEV)	Less Valid ($\chi \pm$ STDEV)	Valid ($\chi \pm$ STDEV)	Very Valid ($\chi \pm$ STDEV)
1	Construction	Learning models	0,00 ± 0,00	0,00 ± 0,00	3,00 ± 8,49	0,00 ± 0,00
		design research	0,00 ± 0,00	0,00 ± 0,00	0,00 ± 0,00	4,00 ± 8,49
		Integrative instruction	0,33 ± 1,89	0,00 ± 0,00	0,67 ± 3,78	1,78 ± 10,06
		Theory of learning	0,00 ± 0,00	0,00 ± 0,00	3,00 ± 4,24	0,00 ± 0,00
2	Characteristics	modern design instructional	0,00 ± 0,00	0,24 ± 2,66	1,94 ± 21,96	0,88 ± 9,98
		KBK PT with KKNl	0,00 ± 0,00	0,00 ± 0,00	1,00 ± 5,66	2,67 ± 15,09
		adaptive instructional system	0,00 ± 0,00	0,4 ± 1,13	1,8 ± 5,09	0,8 ± 2,27
3	Content	0,00 ± 0,00	0,00 ± 0,00	3,00 ± 0,00	0,00 ± 0,00	
4	Language	0,00 ± 0,00	0,00 ± 0,00	3,00 ± 0,00	0,00 ± 0,00	

Table 4 Results of cognitive learning students

No	Criteria		Cognitive Students Achievement (n = 61)			Level of Practicality ($\chi \pm$ STDEV)
	Score	Quality	Σ	X	STDEV	
1	85 – 100	A	29	47.54	13.11	Very Practice (68,27 ± 8,59)
2	80 – 84	A-	9	14.75	4.069	
3	75 – 79	B+	11	18.03	4.973	Practice (11,47 ± 3,16)
4	70 – 74	B	3	4.918	1.356	
5	65 – 69	B-	2	3.279	0.904	Less Practice (3,28 ± 0,90)
6	60 – 64	C+	2	3.279	0.904	
7	55 – 59	C	2	3.279	0.904	No Practice (2,46 ± 0,68)
8	45 – 54	D	1	1.639	0.452	
9	< 45	E	2	3.279	0.904	

Note: Σ = summary (61), χ = mean, STDEV = standart of deviation

Table 5 Result of skills and attitude of students

No	Criteria		Skills and Attitude of students (n = 61)									Level of Practicality ($\chi \pm$ STDEV)	
	Scores	Quality	Review of thesis			Write summary of draft proposal of thesis			Write draft proposal of thesis				
			Σ	χ	STDEV	Σ	X	STDEV	Σ	χ	STDEV		
1	85 – 100	A	2	3.279	0.904	0	0	0	0	0	0	0	Very Practice (1,913 ± 0,527)
2	80 – 84	A-	5	8.197	2.26	0	0	0	0	0	0	0	
3	75 – 79	B+	11	18.03	4.973	4	6.557	1.808	1	1.639	0.452	Practice (11,2 ± 3,089)	
4	70 – 74	B	17	27.87	7.685	5	8.197	2.26	3	4.918	1.356		
5	65 – 69	B-	15	24.59	6.781	3	4.918	1.356	5	8.197	2.26	Less Practice (7,65 ± 2,562)	
6	60 – 64	C+	7	11.48	3.165	2	3.279	0.904	2	3.279	0.904		
7	55 – 59	C	4	6.557	1.808	2	3.279	0.904	2	3.279	0.904	No Practice (25,41 ± 7,007)	
8	45 – 54	D	0	0	0	0	0	0	0	0	0		
9	< 45	E	0	0	0	45	73.77	20.34	48	78.69	21.7		

Note: Σ = summary (61), χ = mean, STDEV = standart of deviation

Table 6 Skills students in understanding articles published in national and international journals

No	Criteria		Skills students in understanding articles published in national and international journals (n = 61)												Level of Practicality ($\chi \pm$ STDEV)
	Score	Quality	Found Articles			Quality Articles			Knowing Articles			Quality of Reviewed Articles			
			Σ	χ	STDEV	Σ	χ	STDEV	Σ	χ	STDEV	Σ	χ	STDEV	
1	85 – 100	A	10	16.39	4.521	10	16.39	4.521	12	19.67	5.425	8	13.11	3.617	Very Practice (23,56 ± 6,50)
2	80 – 84	A-	25	40.98	11.3	12	19.67	5.425	18	29.51	8.138	20	32.79	9.042	
3	75 – 79	B+	10	16.39	4.521	5	8.197	2.26	5	8.197	2.26	5	8.197	2.26	Practice (7,99 ± 2,20)
4	70 – 74	B	4	6.557	1.808	4	6.557	1.808	4	6.557	1.808	2	3.279	0.904	
5	65 – 69	B-	2	3.279	0.904	2	3.279	0.904	12	19.67	5.425	2	3.279	0.904	Less Practice (7,51 ± 2,07)
6	60 – 64	C+	2	3.279	0.904	5	8.197	2.26	2	3.279	0.904	7	11.48	3.165	
7	55 – 59	C	2	3.279	0.904	6	9.836	2.713	5	8.197	2.26	8	13.11	3.617	No Practice (7,17 ± 1,98)
8	45 – 54	D	3	4.918	1.356	8	13.11	3.617	1	1.639	0.452	5	8.197	2.26	
9	< 45	E	3	4.918	1.356	9	14.75	4.069	2	3.279	0.904	4	6.557	1.808	

Note: Σ = summary (61), χ = mean, STDEV = standar of deviation

4. DISCUSSION

The results of this study showed that the product meets the criteria of this research has been written in the prototype validation sheet. Aspects of the assessment is a learning model, design research, integrative learning, learning theory, instructional design model, curriculum based competence with Indonesian qualification frameworks, adaptive instructional system, and language learning material. These results also demonstrate the good of the current prototype used in the learning process or when testing the practicalities implemented. So the researchers concluded not currently required revision of the prototype. The question that must be answered is why this product is valid and practical? In the following section the authors explain the answers to these questions. Explanations followed by writing the arguments are equipped with support or referral source.

4.1. Models of teachings

In the aspect of learning model, I wrote five indicators of syntax, the social system, the principles of reaction, supporting system, and the effects of instructional and nurturant effects [18, p. 14]. The score of product research on learning model was 3.00 ± 8.49 (valid). This explanation shows that the product meets the theoretical aspects of the learning model. The learning model has a broader meaning [24, p. 74]. The learning model has several distinctive features, which are not owned by the strategy and methods of learning. The characteristic of the learning model is (a) the theoretical rational logical compiled by the creators or developers; (b) the rationale about what and how students learn; (c) the behavior of teaching required so that the model can be implemented successfully; (d) learning environment necessary for learning objectives can be achieved. The learning model leads to a certain learning approach, including the purpose, syntax, and environmental management systems.

4.2. Design research

In the aspect of design research, this study wrote four assessment indicators, namely phases of development, the characteristics of the development, evaluation and quality of interventions. Three indicators reviewed in this section. The fourth indicator of the quality of interventions for reviews on the documentation and reflection of systematic and determination of design. This research has been carried out by following the design research phase [15]. The development phase has been carried out properly and systematically. Therefore, the validation results obtained are very valid, which stood at a score of 4.00 ± 8.49 . Plomp explains there are four stages of work in conducting research is preliminary research

design, prototyping stage, assessment phase and documentation and reflection systematics.

This research products containing or having the characteristics of development. Thus concluded this study meets the characteristics of development research. The characteristics described by Van den-Akker et al., (2006: 5) in [15, p. 15]. The characteristics of research development that is (a) interventionist: intervention (interference) when designing research purposes; (b) iterative; the cycle of analysis, design and development, evaluation and revision; (c) the involvement of practitioners; a participatory active at every stage of practitioners and research activities; (d) the process-oriented; aims to understand and improve product quality; (e) oriented usability; improving the quality of the design with the practicalities of the process by the user in the field and (f) oriented theory; the design is based on the conceptual and theoretical framework, supported by in-depth evaluation of the product.

The characteristics of research development could also be seen by the focus, the techniques and tools used when doing research development [25, pp. 1103-1115]. Techniques and equipment research and development combine different types of research methodology and implementing a variety of equipment needed at each execution of the study. The products of this study also indicate that fact. Some of the techniques that can be used is experimental research, qualitative, descriptive survey method. The necessary equipment in the research is the development of the experts which will be used as a determination theory, internal and external validity and statistical analysis [25, pp. 1103-1104].

Design research or/and research and development requires participants. Because the Design research will be done well if it involves participants in that quite a lot. This study has involved participants are designers, students and validators. The participants are (a) designer, developer and evaluator; (b) the client / student / students / learners; (c) teachers and facilitators of the program; (d) the organization; (e) the researcher who mastered the theory of design and development, and (e) the product [25, p. 1115].

Based on these descriptions, there are four conclusions that could be used to support this research, namely (a) design research or/and research development is the study systematically on the process of designing, developing and evaluating models, programs, strategies of teaching-learning and their devices, products, and systems as a solution to the problem complex in practical education, and also has a goal to increase the knowledge about the characteristics of the model, the program, the teaching-learning strategies and their devices, products, and the system; (b) the general stages of research development consists of the design, development, evaluation and implementation; (c) determination of focus, process, conclusions and

results of the study will determine the type and form of development research that will be conducted by researchers who want to conduct research development in the field of learning; and (d) the use and selection of evaluation techniques largely determine the quality of the model, the program, the teaching-learning strategies as well as the device, product, and system [5].

4.3. Integrative instruction

The results of the validation about aspects of integrative learning is invalid (0.33 ± 1.89); less valid (0.00 ± 0.00), valid (0.67 ± 3.78) and very valid (10.06 ± 1.78). The findings of this study show that there is still an indicator of unmet integrative learning. In other words could be written that the product of this study less or do not contain all aspects of integrative learning. I have written nine indicators of integrative learning is interdisciplinary, thinking map, problem solving, learning phase, integrative skills, recitation, debate, discussion and presentation [26]. Based on the results of the validation only interdisciplinary, integrative skills, recitation, discussion and questions and answers that have valid scores, while problem solving and presentation scores invalid. The findings of this study demonstrate that the product does not contain or do not bring up aspects of problem solving and presentation. So it is necessary to improve the next development.

4.4. Theory of learning

The results the validation about learning theory is valid (3.00 ± 4.24). These findings show that the research products are designed with good theory. Because learning theory became the main runway while doing the design of instructional development. Some theories of learning that is relevant to this study is the cognitive, behavioral, constructivist. There are several arguments written by Sink to describe the relationship of learning theory and its implications for learning. First, learning theory contribute to improve the structure of concepts that underlie the process of providing information and stored in the memory long (long term memory) and can be called back in the observation of human perform (Gagne, 1997 in [27, p. 202]. Second, the theory of learning will improve learning strategies, tactics, and behavior learning experiences supported by the theory. For example, on the model of instructional systems design (ISD) designers make use of theories of learning and their learning strategies in the design phase. Third, the results Molenda and Russel (2005) shows the many ways in the development and design of the structure of matter, just as the individual materials, modules, units of learning appropriate to the subject that is always used and is based on one or more learning theory. Instructional design phase of system design is influenced by the behavioristic theory, cognitive and constructivist [27].

The relationship behaviorism, cognitivism and constructivism connecting yesterday's theories to

today contexts (a) change in technology, changes in learners and change in methods; (b) not only do today's students want and prefer to learn differently, they seem exceptionally capable of doing and (c) today, with the use of available technologies, individuals from geographically diverse locations can form communities of learners to develop multidisciplinary solutions to important problems [19, pp. 58-59]. Behaviorism, cognitivism, constructivism: comparing critical features from an instructional design perspective. This explanation used to evaluate theory in design instructional. There are lists seven question, Schunk (1991) lists five definitive questions that serve to distinguish each learning theory from the others: (a) how does learning occur?; (b) which factors influence learning?; (c) what is the role of memory?; (d) how does transfer occur? and (e) what types of learning are best explained by the theory? Expanding on this original list, we have included two additional questions important to the instructional designer: (f) what basic assumptions/principles of this theory are relevant to instructional design? and (g) how should instruction be structured to facilitate learning? The seventh question has been filled with good current study was designed products. For example about the sixth question what basic assumptions/principles of this theory are relevant to instructional design? [19, p. 46]

The behaviorism, there are four specific assumptions or principles that have direct relevance to instructional design include the following (possible current instructional design applications are listed in brackets following the listed principle) are (a) an emphasis on producing observable and measurable outcomes in students (behavioral objectives, task analysis, criterion-referenced assessment); (b) pre-assessment of students to determine where instruction should begin (learner analysis); (c) emphasis on mastering early steps before progressing to more complex levels of performance (sequencing of instructional presentation, mastery learning); (d) use of reinforcement to impact performance (tangible rewards, informative feedback); and (e) use of cues, shaping and practice to ensure a strong stimulus response association (simple to complex sequencing of practice, use of prompts) [19, pp. 49-50]. The cognitivism, specific assumptions or principles that have direct relevance to instructional design include the following (possible current instructional design applications are listed in brackets following the listed principle) are (a) emphasis on the active involvement of the learner in the learning process (learner control, metacognitive training, e.g., self-planning, monitoring, and revising techniques); (b) use of hierarchical analyses to identify and illustrate prerequisite relationships (cognitive task analysis procedures); (c) emphasis on structuring, organizing, and sequencing information to facilitate optimal processing (use of cognitive strategies such as outlining, summaries, synthesizers, advance organizers, etc.) and (d) creation

of learning environments that allow and encourage students to make connections with previously learned material (recall of prerequisite skills; use of relevant examples, analogies). The constructivism, the following are several specific assumptions or principles from the constructivist position that have direct relevance for the instructional designer (possible instructional design of applications are listed in brackets, following the listed principle) are (a) an emphasis on the identification of the *context* in which the skills will be learned and subsequently applied (anchoring learning in meaningful contexts); (b) an emphasis on learner control and the capability of the learner to manipulate information (actively using what is learned); (c) the need for information to be presented in a variety of different ways (revisiting content at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives); (d) supporting the use of problem solving skills that allow learners to go “beyond the information given” (developing pattern-recognition skills, presenting alternative ways of representing problems); and (e) assessment focused on transfer of knowledge and skills (presenting new problems and situations that differ from the conditions of the initial instruction) [19, p. 53]

4.5. Construction

4.5.1. Design instructional modern

In the aspect of modern instructional design, validation results obtained are less valid (0.24 ± 2.66), valid (21.96 ± 1.94) and a very valid (0.88 ± 9.98). These results were obtained from the 18 indicators, the nature of learning, typical learning structure, view of the state of knowledge, typical classroom climate, diagnosis of needs, purpose of intervention, view of human nature, learners attitude, possible answers, motivation to learn, change or improve, the role of experience, learner self-concept, learner orientation, learning objectives, how need established, instructional design, learning process (Anonymous, 2000). These results were obtained for all of the characteristics of modern instructional design were fulfilled in this study product. These results also show that this product has been built to build instructional system that is effective and efficient. Instructional models modern is a systematic process of building a instructional system that is effective and efficient, conducted by professors, teachers, lecturers and trainers or referred by teachers or staff who work specifically as an instructional designer in educational institutions. Some of the advantages of modern instructional design, namely (a) be equipped with a variety of the latest so that the substance reference date, while various references is retained because it is still relevant; (b) creating instructional systems in various contexts, both in face-to-face instructional activities in the regular classroom as well as to design self-learning materials; (c) used mainly for distance education, including computer-based instructional

activities (computer based instruction); (d) use various concepts drawn from various sciences, especially learning of theory, motivation theory, learning theory, the theory of program evaluation and communication theory; (e) activities is revise instructional materials of an integral part of the formative evaluation so not described as a separate activity; (f) the modern instructional design load on the system is expected to sharpen the payment as a systems view (system view) and a systems approach (system approach); (g) modern instructional design load on competency-based learning is expected to sharpen the government's operational policy on competency-based education. [4].

4.5.2. Curriculum based competence with Indonesian qualification framework

The result of validation about curriculum based competence with Indonesian qualification frameworks, are valid (1.00 ± 5.66) and a very valid (15.09 ± 2.67). These results were obtained from nine (9) indicators, namely phases of preparation, student center learning, learning tools, evaluation of learning, the establishment of vision, mission, goals and graduate profile, establishment of frameworks national qualifications Indonesia level 6, the determination of competence of graduates /outcomes of learning, determination map element of competence with the competence of graduates and determination of the main points of the study of learning. These results show that these products, designed in accordance with the stages of preparation of a competency-based curriculum for universities. This product also has the characteristics of student learning center and characterize the Indonesian national qualifications framework at level 6. Documents Tadris Biology curriculum STAIN Batusangkar which have been designed in accordance with the Indonesian national qualifications framework is written that a generic description of level 6 (the first paragraph) is able to utilize science and technology in areas of expertise and able to adapt to the situation at hand in problem solving, with specific descriptions (1) is able to master and apply knowledge and technology related to biological learning process; and (2) are able to solve the problems of biology in the classroom learning using information technology approach.

Referring to the competencies that have been written on the product, this course has a general competence which contains elements of completion of the task with a clear result. The definition of competence. There are many opinions of experts about the competence was review [4, p. 65]. Results of the review authors write back. First, the competence shown by the capabilities of the completion of the task with the results being between good and very good scale. This conclusion was obtained after a study of the three characteristics, namely (a) the competence that is a combination of three human capabilities are combined insights that cognitive, skills and attitude to

improve the work; (b) competency has a strong indicator of an increase in performance up to the level of good or very good and (c) the competence is a combination of knowledge, skills and behaviors is the basis for performance. Second, competence is indicated with minimal performance both as a result of use capabilities. Ability itself is application of a combination of knowledge, skills and attitudes behavior. This conclusion is based on the results of the study obtained from (a) capability is the basis of competence, which means that a person has achieved competence of capabilities; (b) capability may be derived from two sources, namely descent and aptitude and achievement results from professional capability in the work; (c) the knowledge, skills and attitudes of behavior is an important part of competence.

4.5.3. Adaptive instructional system

In the adaptive instructional system, the validation results obtained are valid (1.00 ± 5.66) and a very valid (15.09 ± 2.67). These results were obtained from five (5) indicators that is the main component, adaptability procedure, adaptability at the micro level, new pedagogical approaches and the three phases are input, and output transactions. These findings related on (a) main components of instruction such as instructional goals, depth of curriculum content, and delivery systems; (b) to adapt specific instructional procedures and strategies to specific student characteristics; (c) to adapt instruction on a micro-level by diagnosing the student's specific learning needs during instruction and providing instructional prescriptions for the needs; (d) new pedagogical approaches such as metacognitive strategies, collaborative learning, constructivist learning, and motivational competence and (e) three stages: input, transactions and output [3].

The adaptability of the product to the learning needs of research methods can be seen from some of the findings that have the following characteristics. *First*, learning meet the diversity of students. This adaptive requirements the efforts to develop and implement adaptive instruction have taken different approaches based on the aspects of instruction that are intended to adapt to different students. The first approach is to adapt instruction on a macro-level by allowing different alternatives in selecting only a few main components of instruction such as instructional goals, depth of curriculum content, and delivery systems. The second approach is to adapt specific instructional procedures and strategies to specific student characteristics. Because this approach requires the identification of the most relevant learner characteristics (or aptitudes) for the instruction and the selection of instructional strategies that best facilitate the learning process of the students who have the aptitudes, it is called aptitude-treatment interactions (ATI). The third approach is to adapt instruction on a micro-level by diagnosing the student's specific learning needs during instruction and providing

instructional prescriptions for the needs. The degree of adaptation is determined by how sensitive the diagnostic procedure is to the specific learning needs of each student and how much the prescriptive activities are tailored to the learner's needs. Depending on the available resources and constraints in the given situation, the instruction can be designed to be adaptive using a different combination of the three approaches. The arguments in favor of the above statement. The micro adaptive instructional models using on-task measures are likely to be more sensitive to the student's needs. Some researchers have attempted to establish micro-adaptive instructional models using on-task measures rather than pre-task measures. On-task measures of student behavior and performance, such as response errors, response latencies, and emotional states, can be valuable sources for making adaptive instructional decisions during the instructional process. That is, most tutoring activities are determined by the tutor's intuitive judgments about the student's learning needs and ability for the given task. Also, one-on-one tutoring is virtually impossible for most educational situations because of the lack of both qualified tutors and resources. A typical example of micro-adaptive instruction is one-on-one tutoring. The tutor selects the most appropriate information to teach based on his or her judgment of the student's learning ability, including prior knowledge, intellectual ability, and motivation. Then the tutor continuously monitors and diagnoses the student's learning process and determines the next instructional actions. The instructional actions can be questions, feedback, explanations, or others that maximize the student's learning. As the one-on-one tutorial process suggests, the essential element of micro-adaptive instruction is the ongoing diagnosis of the student's learning needs and the prescription of instructional treatments based on the diagnosis. Instructional researchers or developers have different views about the variables, indices, procedures, and actions that should be included in the diagnostic and the prescriptive processes, that different adaptive systems have been developed to adapt different features of instruction to learners in different ways [3, pp. 652-661].

Secondly, the research findings also showed micro adaptive instructional characteristics as required. The micro adaptive model uses the temporal nature of learner abilities and characteristics as a major source of diagnostic information on which an instructional treatment is prescribed. Thus, an attribute of a micro adaptive model is its dynamic nature as contrasted with a macro adaptive model. *Thirdly*, the founding of research identically with adaptive web-based instruction. Treatments variables in micro adaptive models, intelligent tutoring systems, adaptive hypermedia and adaptive web-based instruction. *Fourthly*, this study was designed several assignments for student mastery of the skills associated with the use of computers and the Internet. These tasks is one

part of the product is designed. These findings show that there are characteristics adaptive hypermedia and adaptive web-based instruction. While most adaptive systems reviewed in the previous sections could not be developed without programming skills and were implemented in the laboratory settings, recent authoring tools allow nonprogrammers to develop adaptive hypermedia or adaptive web-based instruction and implement it in real instructional settings. Adaptive hypermedia or adaptive web-based systems have been employed for educational systems, e-commerce applications such as adaptive performance support systems, on-line information systems such as electronic encyclopedias and information kiosks, and on-line help systems. Adaptive hypermedia methods apply mainly to two distinctive areas of adaptation: adaptation of the content of the page, which is called content-level adaptation or adaptive presentation; and the behavior of the links, which is called link-level adaptation or adaptive navigation support [3, pp. 666-668].

Fifthly, the study also discovered and explained the new teaching methods to methods of research. This finding is consistent as a new pedagogical approaches in adaptive instructional systems. On the late nineties, researchers began to incorporate more complex pedagogical approaches such as metacognitive strategies, collaborative learning, constructivist learning, and motivational competence in adaptive instructional systems. Sixthly, the result has meet three stages: input, transactions and output. The input stage basically consists of the analysis of the student's entry characteristics. The student's entry characteristics include not only this or her within-lesson history (e.g., response history) but also pre-lesson characteristics. The pre-lesson characteristics may include information about the student's aptitudes and other variables influencing his or her learning. As discussed earlier, the aptitude variables measured prior to instruction will be useful for the beginning stage of instruction but will become less important as the student's on-task performance history is accumulated. Thus, the within-lesson history should be continuously updated using information from the evaluation of the performance (i.e., output measures). The transaction stage consists of the interactions between the student and the system. In the beginning stage of the instruction, the system will select problems and explanations to present based on the student's entry characteristics, mainly the premeasured aptitudes. Then the system will evaluate the student's responses (or any other student input such as questions or comments) to the given problem or task. The response evaluation provides information for diagnosing the student's specific learning needs and for assessing overall performance level on the task. The learning needs will be inferred according to diagnostic rules in the system. Finally, the system will select new display presentations and questions for the student according to the tutorial rules. The tutorial rules should be

developed in consideration of different learning and instructional theories (e.g., see Snelbecker, 1974; Reigeluth, 1983), research findings (e.g., see Gallanher, 1994; Weinstein & Mayer, 1986), expert heuristics (Jonassen, 1988), and response-sensitive strategies discussed earlier in this chapter. The output stage consists mainly of performance evaluation. The performance evaluation may include not only the student's overall achievement level on a given task and specific performance on the subtasks but also the analysis of complete learning behaviors related to the task and subtasks. According to the performance evaluation and analysis, the instructional components will be modified or updated. The instructional components to be updated may include contents in the knowledge base (including questions and explanations), instructional strategies, diagnostic and tutorial rules, the lesson structure, and entry characteristics. If the system does not have the capability to modify or update some of the instructional components automatically, a human monitor may be required to perform that task. [3, pp. 673-678].

4.6. Content and language

In the aspect of the content, the researchers use a book that has been designed by Gay, et al., (2009). Textbook is equipped with a media power point. Selection and use of this product caused by the product is in accordance with the core competencies and competency supporters who have written in the previous section. These products are written by experts who have been published regularly and has been revised to perfection by the author. These products always contains the latest information on educational research. Fourth, based on the writer's observation almost every researcher, lecturer, teacher, student, students and education observers use this text book. In conclude, so this product is valid and practical aspects of language and content.

4.7. Documentation and reflection of systematic and determination of design

The findings practicalities test results show that (1) the cognitive learning of students is very practical (68.27 ± 8.59), practical (11.47 ± 3.16), less practical (3.28 ± 0.90), not Practical (2.46 ± 0.68) and are not practical, (2.46 ± 0.68); (2) skills of students in studying the thesis, writing summaries and proposals are very practical (1913 ± 0527), practical ($11.2 \pm 3,089$), less Practical (7.65 ± 2562) and cumbersome (25.41 ± 70.07) and (3) skills of students understand articles published in national and international journals is very practical ($23.56 \pm 6,50$), practical (7.99 ± 2.20), less practical (7.51 ± 2.07) and practical (7.17 ± 1.98). These findings show that the learning process that has been implemented into stages that are essential to the achievement of key competencies in the subjects of biology education research. Because the competency-based learning has meaning (a) the learning process is designed and implemented in

accordance with the competencies defined in the learning objectives; (b) the learning process was designed and implemented from the competence of learners who have mastered before following the learning process, the next stage of learning is done systematically; (c) all components are in a learning system was designed and implemented to create a learning process that leads to the achievement of competencies that have been formulated in learning goals; and (d) measurement successful learning is done to determine the level of achievement of the competence of learners [4, p. 79].

The findings of this study also includes the importance of mastery of the competencies and level 6 or level 7 should be given to undergraduates. Achievement of these competencies must be stated in the curriculum document. The curriculum at college is a set of plans and arrangements regarding the content and study materials and lessons as well as the delivery and assessment is used to guide the delivery of teaching and learning in higher education. The role of curriculum in higher education is (a) higher education management policy to determine the direction of education; (b) philosophical formation that will color the academic community and the climate; (c) patron or learning patterns; (d) atmospheric or climatic formed from the interaction of managerial universities in achieving learning goals; (e) a reference quality of the quality assurance process and (e) measure college success in producing graduates that are beneficial to society.

This product has a benefit in achieving the competency level 6. [28, pp. 8-9]. The document discovered at the benefits and impact of the Indonesian National Qualifications Framework. Researchers write back about it. About the benefits, the Indonesian National Qualifications Framework is intended to (a) establish the qualifications of learning outcomes acquired through formal, non-formal, informal or work experience; (b) establishes a scheme recognition of qualifications acquired learning outcomes on formal education, non-formal, informal or work experience; (c) equalizes qualifications between learning outcomes acquired through formal education, formal education, non-formal, informal or work experience; and (d) developing methods and system of recognition of qualifications of human resources from other countries who will be working in Indonesia. The impact of the Indonesian National Qualifications Framework are (a) to increasing the quantity of Indonesian human resources quality and international competitiveness in order to ensure the increased accessibility of Indonesian human resources to the labor market; (b) to increasing the contribution of learning outcomes obtained with formal education, non-formal, informal or work experience in the growth of the national economy; (c) to increasing academic mobility to increase mutual understanding and solidarity and cooperation anta state of higher education in the world and (d) to increasing

recognition of other countries both bilaterally, regionally and internationally to Indonesia without leaving the traits and personality of the Indonesian nation. Related to this, the Directorate General of Higher Education expects (a) Institute of Personnel Organizer becomes a mirror of education for another course as a mother character education; (b) Institute of Personnel Organizer become a source of superior human resources in education; (c) Institute of Personnel Organizer open to changes and future-oriented and (d) Institute of Personnel organizers are willing and able to produce powerful educators, creative, and infectious goodness for the glory of future generations.

For comparison, I have done a review of several studies relevant to the research that has been done this. In the previous section has been written that others have reviewed the literature on integration in instructional design. The results show that the aspects relevant to the research that (a) the design aspects of development; (b) aspects of the use of the concept of the model; (c) aspects of the evaluation of the model, including the use of test validity; (d) aspects of integration; and (e) the development aspects in developmental of biology [5]. Several other studies that is relevant with this research are (a) instructional design strategies for intensive online course: an objectives-constructivist blended approach [29], an instructional design in education: new model [30], blended learning instructional design: a modern approach [31] and an instructional design framework for authentic learning environments [32].

Based on the explanation of the findings of this study, then compared with other research reports, this study has limitations. Some limitations is the use of self-evaluation in a way to test the validity. Theoretically, self-evaluation can be carried out because of the strong support that theory. Tessmer (1999) explains that self-evaluation is one way to assess product development results. While research and development, researchers are often faced with a difficult situation that will affect the quality of the product, especially the learning model. Because the study required the collaboration within the team. For example collaboration between researchers with practitioners, the collaboration between the evaluators and other participants. Sometimes there is a clash of interests and needs which will lead to a different perception when the research done in the field. The conditions described will cause a dilemma in development research [15, pp. 31-32].

In this study, evaluation techniques are selected and used to determine the quality of products, and the criteria for product quality development results [33]. Based on evaluation techniques, the product because it uses self-assessment (self-evaluation). This criterion shows the quality of the product is low resistance to revision. Evaluation techniques are self-evaluation, expert review, one-to-one evaluation, small group or micro evaluation and field test. The results of the

development of good learning outcomes depend on quality product development. The quality of learning development in research and development is determined by the criteria of validity, practicality and effectiveness. This study uses have used the principle of validity, practicality and effectiveness, this is called tessmer's evaluation [33, pp. 93-94].

In practical terms, many conditions other dilemma researchers found when doing research development. In order for research purposes continues to run according to the principles of research development, Mc-Kenny et al. (2006) describes a picture of the dilemma and the solution to the condition [33]. The conditions and the solution is (a) researchers is the designer, sometimes as evaluators and implementers (b) the state or condition of the field and the conditions of adaptability. Currently, research and development carried out, sometimes researchers are also involved as designers, evaluators and implementers. There are three compensation that can be done by researchers to solve this problem: first, making research and discuss openly with others who are professionals who are not involved directly or indirectly with the study. Researchers are open to suggestions and criticism of the person. Second, the paradigm researchers during or at the beginning of the study was a creative perspective, and a researcher who paradigm critical perspective on the end of the study. Third, have a research design with good quality. Some good development research design criteria are (a) have a problem, ideas and strong reasons (strong chain reasoning); (b) increase the quality of methods, techniques and analysis of good data (triangulation); (c) to test the practicalities and effectiveness (empirical test); (d) the process of documentation, analysis and reflection systematically during the design, development, evaluation and implementation (documentation, analysis and systematic reflection); and (e) using a variety of methods and strategies in research, for example, using practitioners and other researchers as a critical friend, using the observer more than one.

Research and development is closely related to practices in the field. Circumstances or conditions in the field often and effect to research. A frequent problem is the unwillingness or properties that do not open from the participants (other educators, principals, chairman of the institutions and others) and does not support research in accordance with the design. To that end, researchers should be able to be an outsider when the study was conducted. Aspects of objectivity and honesty should be prioritized by the researcher. That research conducted properly and in accordance with the principles of research development. The adaptability of the study will determine the results. The problem that often arises is the inability or lack of conceptual design studies inability to adapt to conditions on the ground. According to Van-den-Akker (2005) adaptability between research and practice in the field can be maximized in several ways,

namely full preparation in research, tolerant, open and receiving input from other parties [15, p. 31].

5. CONCLUSION

This research has produced an instructional design modern in the course of educational research methods. The result of the preliminary stage is the existence of a problem that causes gaps in learning research methods. The gap in the form of (a) analysis of instructional needs shows that the learning process should be characterized applying based National Qualifications Framework Indonesia, in accordance with the vision of the institution and the student is able to understand the concept of research as well as being able to write proposals and reports of research in the field of education and (b) analysis of behavioral and baseline characteristics of students showed that students have diverse characteristics. Results of the research prototype stages are (a) the construction design of the prototype demonstrates that there are 9 main competencies and 14 supporting competencies that must be mastered by the student; (b) the construction of the prototype design show 8 theories and concepts used in the design; and (c) the results of validation prototype is valid with many revisions that must be done by the researcher. The results of the assessment phase of research is practically on the terms of the practicalities of test results which contained three aspects of the cognitive learning, skills and attitudes.

This research has produced an instructional design modern in the course of educational research methods. The need to revise the product to align learning syntax premises actual conditions. Necessary to test the validity of using an external expert review to improve the resistance of the product. Necessary to test the practicalities of using a wider scale externally to increase the resistance of the product.

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