

# Implementation of science process skills using ICT-based approach to facilitate student life skills

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**Abstract.** The purpose of this study is to describe the results of the implementation of a teaching-learning package in Plant Physiology courses to improve the student's life skills using the science process skills-based approach ICT. This research used 15 students of Biology Education of Undergraduate International Class who are in the Plant Physiology course. This study consists of two phases items, namely the development phase and implementation phase by using a one-shot case study design. Research parameters were the feasibility of lesson plans, student achievement, Including academic skills, thinking skills, and social skills. Data were descriptively Analyzed According to the characteristics of the existing data. The result shows that the feasibility of a lesson plan is very satisfied and can be improvements in student's life skills, especially with regards to student's thinking skills and scientific thinking skills. The results indicate that the science process skills using ICT-based approach can be effective methods to improve student's life skills.

## 1. Introduction

*In 21<sup>st</sup> Century Information and communication technologies (ICT)* have become very common today in many aspects of life. ICT is also becoming very important in the social and economic life of society. The field of education is also now taking advantage of ICT in learning, but the effect is not covering other aspects. More education leads to traditional educational activities, where professors become the center of information and attention of students. The demands of 21<sup>st</sup>-century education forced the shifting of paradigms. Students are required to master ICT effectively as one's ability to compete in the 21<sup>st</sup> century [1, 2].

Student results based on observations conducted by researchers showed that academic achievement by using traditional methods alone had unsatisfactory results. These obstacles arise because the materials studied abstract so that the student is difficult to establish the concept of knowledge. Learning by using ICT has many advantages, one of which is learning can be done independently. Students can use computer animation to understand the concepts learned. Attewell *et al.* believe that technology can make learning becomes easier [3], but it takes too much training, preparation and production of appropriate materials for such learning to be more effective [4].

As the education world continues to grow, various phenomena in the development of real-life demands graduates have a variety of skills to face the competition. National Council for Curriculum and Assessment (NCCA) conduct online surveys to evaluate the response of academics know the priority that should be practised in the world of education. One result of the survey is important to develop life skills [5]. MONE explaining the concept of life skills (*life skills*) as follows: the



generic life skills consist of personal skills (*personal skills*) and social skills (*social skills*). Personal skills also include academic skills (*academic skills*). While the specific life skills (*specific life skills*) consisting of academic skills (*academic skills*) and skills vocational (*vocational skills*)[6].

Tim Broad-Based Education Education Ministry argued that the purpose of life skill education is to: (1) to actualize the potential of learners that can be used to solve problems encountered, (2) provide an opportunity for the school to develop flexible learning, in accordance with the principle of broad-based education and (3) optimizing the use of resources in the school environment, by allowing the use of existing resources in the community, in accordance with the principle of school-based management [7]. Those goals are the main purpose of life skill education is to prepare students to be concerned is able, capable and skilled maintain the viability and growth in the future [8].

## 2. Methods

This study implemented a variety of learning models are packed with the application process skills-based approach to ICT for Plant Physiology courses with related concepts which include enzyme plant metabolism, photosynthesis, respiration, and nitrogen metabolism. This study consisted of two phases, the first phase of the development of learning tools, and the second stage is the implementation of learning tools Process Skills ICT to teach *Life Skills* students.

Assessment skills (life skills) includes several components that are tailored to the skills of the selected process as an approach to this learning process. life skills (life skills) that are Life generic for Skills consist of personal skills(*personal skills*) and social skills (*social skills*). Personal skills include academic skills (*academic skills*), while the specific life skills(*specific life skills*) consisting of academic skills (*academic skills*). Learning software development using 4-D models which consists of four stages namely *Define* (definition), *Design* (Design), *Develop* (Development) and *Disseminate* (deployment). The study design when implementing the learning device is a *One-Group Pretest-Posttest Design* developed by Campbell and Stanley [8]. Subjects were students of International Class is being reprogrammed subjects Plant Physiology, the student of class 2012, which amounted to 15 people. The research was conducted in the Department of Biological Science Education UNESA, the even semester 2013/2014 year.

## 3. Results and Discussion

### 3.1. Results

Summary of results score of implementation learning SAP at the meeting of 1, 2, 3, and 4 are presented in Table 3.1 show that for every aspect observed for each category include: (1) introduction, (2) the core activities and (3) cover respectively show a score of 4; 3.6; and 3.5 which are in both categories. For implementation learning instrument reliability value of 97%. These results indicate that the enforceability of the skills-oriented learning processes used to improve *life skills* students can be done well.

Student mastery learning data obtained by administration of *post-test* the first and second to students at the end of the lesson, Achievement test product is a test mastery of the material on the topic of water transport, translocation through the phloem, enzymes, photosynthesis and respiration, while the achievement test used to measure aspects of the process of *thinking skills* and aspects of *academic skills*. The results of the analysis of students' test results are shown in Table 3.2.

From the results of student learning completeness in Table 3.2 can be revealed that the results *test* of students is reaching the classical completeness with an average value of 76.42 which is the range of values with the letter B +. But there are three students who have not completed to obtain the value of B such provisions considered sufficient thoroughness to this course is B, such as students with no 1, 3 and 5. In addition to learning the results of the product, in this study also uses the test results to the process of learning know the *life skills* (*thinking skills* and *academic skills*)students.

**Table 3.1** Implementation of Oriented Learning Skills Process

		Meeting 1, 2, 3, 4		X	$\bar{X}$	Criteria
No.	Implementation stages of learning	Score				
		O1	O2			
1.	Introduction				4	Good
a.	Motivating students	4	4	4		
b.	Delivering Destination	4	4	4		
2.	Core				3.6	Good
a.	Convey information using ICT media	4	4	4		
b.	Dividing the students into groups of	4	4	4		
c.	Guiding / demonstrate the skill-oriented activities	4	4	4		
d.	Students perform observation and measurement activities	4	3	3.5		
e.	Students take notes and organize data of activities, observation or measurement	3	3	3		
f.	Students formulate conclusions	3	4	3.5		
g.	Students report and present the results of observations	3	3	3		
3.	Closing				3.5	Good
a.	Reflecting the learning outcomes	4	3	3.5		
	Total	37	36	36	3.6	
Reliability		97%				

Description:

O1: Observer 1

O2: Observer 2

X: Average

**Table 3.2** Mastery Learning Results Products (Content Mastery)

Students	Value of Learning Outcomes Products			
	Post Test 1		Post Test 2	
	Score	Completeness	Score	Completeness
1	66	C	60	NC
2	79	C	74	C
3	59	CC	52	NC
4	72	C	78	C
5	69	C	65	C
6	80	C	76	C
7	92	C	91	C
8	76	C	81	C
9	93	C	89	C
10	84	C	78	C
11	72	C	68	C
12	89	C	83	C
13	81	C	75	C
14	75	C	71	C
15	to 80	C	74	C
$\bar{X}$	78.5	C	74.3	C

average value overall: 76.42

Description: C: Completed

NC: Not Completed

Range of values 1-100

Scores of the learning outcomes process are presented in Table 3.3.

**Table 3.3** Mastery of Learning Outcomes Indicators for Measuring Life skills

Student	Learning Outcomes			
	Thinking Skill Score		Academic Skill Score	
	Score	Completeness	Score	Completeness
1	70	C	73	C
2	98	C	74	C
3	66	C	70	C
4	91	C	77	C
5	69	C	71	C
6	82	C	76	C
7	68	C	89	C
8	89	C	82	C
9	85	C	86	C
10	81	C	73	C
11	81	C	75	C
12	91	C	85	C
13	85	C	82	C
14	87	C	79	C
15	76	C	82	C
average	81.3	C	72.3	C

average Rating Overall: 76, 8

Description: C: Completed

Range of values 1-100

Based on Table 3.3 it can be seen that the average results learning process to test the 1st and 2nd measure thinking skills(*thinking skills*)and Academic Skills(*academic skills*)are respectively 81.3 and 72.3. These results suggest that mastery learning process for all students achieved the following study. Figures obtained are relatively varied but generally, show good results with the average value of B +.

Thinking skills(*thinking skills*)and Academic Skills(*academic skills*)students, it can be seen from the values obtained after the student answer the test results that reflect aspects of the process of learning *thinking skills* and *academic skills*.Details of *thinking skills* and *academic skills* of students are shown in Table 3.4.

**Table 3.4** Summary of *Thinking Skills* and *Academic Skills* Score

No. LO	No. Item	Domains Cognitive	Test 1		Test 2		Mean
			Score		Score		
Thinking Skills							
1	1	C5	85	C	80	C	83
1	2	C6	80	C	85	C	83
1	3	C6	80	C	80	C	80
2	4	C5	86	C	87	C	87
3	5	C4	86	C	80	C	83
4	6	C4	90	C	90	C	90
5	7	C4	90	C	80	C	85
6	8	C5	85	C	85	C	85
Academic Skills							
1	9	C6	86	C	80	C	83
overall average: 84.33							

Description: C: Completed

LO: Learning Objectives

Range of values 1-100

Based on Table 3.4 can be disclosed that in test 1 and 2 percentage thoroughness of *thinking skills* and *of academic* achieve mastery skills, with an average reach 83 (rated A- on to the system font). Observation of social skills(*Social skills*) is recorded using the observation sheet social skills(*social skills*)when students perform lab activities and presentation of observations. The percentage breakdown aspects of social skills emerge, are presented in Table 3.5.

**Table 3.5** Percentage of Social Skills

Table 6.10 Percentage of Social Skills											
Aspects	Indicator	Aspects observed	Meeting								Average
			1		2		3		4		
			P1	P2	P1	P2	P1	P2	P1	P2	
social skills( <i>Social skills</i> )	1. The ability to work together in groups of 2. the ability to communicate with the environment	1.1 Understanding the role of members of the group	13	12	12	12	11	13	14	13	12.5 = 83.3%
		2.1 ability to communicate with other of members the group	13	14	13	13	13	14	13	13	13.3 = 89,3%
		2.2 ability to communicate with other groups	9	9	7	8	10	11	12	11	9,5 = 63,3%
		2.3 Being able to use language communicative orally	10	9	7	8	10	10	8	8	8,9 = 59%
		2.4 Can using communicative language in writing	11	12	10	10	12	11	10	9	10.5 = 70%
Description:		P1 =observer 1				P2 =observer 2					

According to Table 3.5 show that in general, assessment of social skills ranging from grades 59% to 88.9%. This means that if used a scoring system that applies in Unesa then the average value of the social skills of students still at a fairly wide range of values of between grades C to A. Social skills are still low since the ability to use verbal communicative language is followed by the ability to use language communicatively in writing.

This study begins to develop learning tools courses *Plant Physiology*-based process oriented ICT skills to improve *life skills* student incorporating ICT-based animation media. Further validation was done by a team of experts in the field of plant physiology to get feedback and suggestions regarding the feasibility of learning tools developed for the learning process using English as the language of instruction. SAP (Lesson Plan) prepared in accordance with good process skills approach basic skills processes and integrated process skills.

Based on the results of the analysis indicate that the validation and revisions have been made to the SAP (Lesson Plan) and the completeness of their supporters could feasibly be used to study skills-oriented processes and ICT-based and feasible to improve *life skills* (*thinking skills*, *academic skills*, and *social skills*)to students being programmed course *Plant Physiology*. MFIs are arranged oriented learning process skills approach to teaching *life skills* that include *thinking skills*, *academic skills*, and *social skills*.The analysis showed that students had no difficulty in following the process of

learning the skills approach. The results of the validation of THB. THB products and processes from the material aspect also received good ratings and feasible to be implemented (data not shown).

Implementation observed learning involves three aspects: (1) The preliminary activities, (2) the core activities, and (3) Event cover. Worth mentioning that when designing learning device, prepared in accordance with the theory of *scaffolding* and cognitive apprenticeship expressed by Vygotsky. Theory *Scaffolding* is defined as the process of assistance from other people who have more knowledge (professors or fellow students) to people who are a little more knowledge to address the problems that go beyond the current level of development [8]. It is very necessary to improve the ability of students, especially in improving the ability of *life skills* that are indispensable as the provision of public life in order to be a successful man and capable of being in the environment with appropriately in accordance with its function.

Cognitive apprenticeship theory defined on the process whereby a person who is learning step by step acquire expertise in interaction with an expert, who serves as an expert, in this case, is an adult or an older person. In this case, can be interpreted faculty adviser subjects or peers who know more about the problem [9]. This can be proven at the time of the learning activity, students conduct discussions with peers and with faculty or co-assistant to solve the problems encountered at the time of observation or process skills activities. After completing this activity, students discuss with members of the group and then present the results of their discussion to the other groups.

Implementation of the learning device oriented ICT skills-based process, also in accordance with Annex Permendiknas No 22 of 2006 on the Content Standards Subjects Biology, which forms positive attitudes towards biology to realize the regularity and beauty of nature and exalt the greatness of God Almighty. Fosters scientific attitude, honest, objective, open, critical resilient and able to cooperate with others. This becomes very necessary and important for the students of Biology Education S1 as a form of imitation how they can translate the implementation in accordance with the demands of the Content Standards Curriculum. The importance of the use of ICT in learning is also supported by research done previously, that the use of ICT can enhance students' science learning outcomes [10]. Another study also describes the use of ICT in learning can increase student engagement in learning [11]. Activities that support it can be seen from the data processing that is adjusted on the basis of observations made, not made-up and be honest.

Besides the achievement of basic competency courses in *Plant Physiology* can be facilitated by using process skills approach to teaching *life skills*. Aspects *thinking skills* and *academic skills* can be seen in the learning activities with process skills approach that includes: making the formulation of the problem, identify variables, make observations, collect data and analyze the results of observations, and make inferences observations. *Social skills* can be seen clearly at the stage students discuss analyze and report the results of observation in the group. SAP enforceability of the instrument reliability of 97% indicates that the instrument used has a value that is reliable [12]. In this case, it can be assumed that the instruments used are reliable.

After the learning process-oriented skills, students who have achieved mastery to value B as many as 12 students from 15 students of International Class S1 is being reprogrammed subjects *Plant Physiology*. However, there is still a value of C according to Unesa pass mark is still within the range of passing. Mastery learning students after learning of ICT-based process-oriented skills is due to the learning process practised skills in an organized process. While it is known that the learning process skills will give a good impact for students, such as [13]: 1) Students undergoing the process to get the concept, formula or description of something so that students can understand it; 2) Students will actively participate in learning activities; 3) Allows students to develop a scientific attitude and stimulate curiosity; 4) Students will gain a sense of who actually lived because of their own to find a concept or generalization of the results of its work; 5) Understanding students about a concept or principle steadier allowing students to be able to apply them to other more relevant issues; 6) Students are satisfied with the results of observations and findings as one of the factors to foster intrinsic motivation in students; 7) Through this approach, the development of science and concept changes that might occur readily accepted; 8) Students are trained in activities required by science as practiced by



scientists; 9) the student Skills acquired will be useful in everyday life; 10) The possibility of maximum utilization of the environment as a learning resource; 11). Familiarize students to express their opinions in a systematic way and respect the opinions of others.

Please also note that training process skills, students will be more easily controlled and appreciate the subject matter, because students are directly involved in the learning process. Provision of direct experience is emphasized through the use and development of process skills and scientific attitude with the goal of understanding the concepts and be able to solve the problem so that the results of student learning are maximized and students achieve mastery learning.

In addition, skills in the learning process of this subject also packaged based on ICT, given that many or most of the concepts contained in the subject of *Plant Physiology* are abstract. Therefore we need the help of the media that is able to bridge to translate what the abstract becomes easier to visually follow. Easy to follow visually abstract process is expected to be used as a bridge improve the cognitive abilities of students of both products and processes.

Achieving mastery learning outcomes-oriented process *thinking skills* and *academic skills*-oriented learning skills indicate that ICT-based process can improve the ability to *life skills* in students. Learning the process skills approach, giving students the opportunity to interact directly using the tools of the experiment so that *life skills* can be trained and the students can use the trial properly and in accordance with the objectives expected when students have activities in the Lab.

As it is known that the principle of learning-oriented life skills(*life skills*)more to the contextual learning, namely the relationship between real-life environment and experiences of students, as well as the process of learning the skills approach. Students learn the material in class, should not only be prepared only as researchers alone, but they must be possessed multidimensional thinking like that done by a researcher [14]. Skills are a very important process to achieve this and generate mindset to act as a science student, discovered by researchers [15]. Process skills can be described as the ability to use a researcher during their work duties and competence demonstrated during the resolve scientific problems [16]. There are a variety of skills in the process of skills, these skills consist of basic skills(*basic skills*)and integrated skills(*integrated skills*).Basic skills consist of six skills, namely: observing, classifying, predicting, measuring, conclude, and communicate. For skills integrated comprising: identifying variables, tabulating the data, present data in graphical form, describe relationships between variables, collect and process data, analyze research, develop hypotheses, defining variables operationally, designed the study, and carry out experiments [17 ]. These skills can simultaneously facilitate students on life skills.

Thinking skills(*thinking skills*)is the proficiency in using ratios or mind, which includes among other things: prowess identify and find information, process and make decisions, and solve problems creatively. Academic skills are often called intellectual prowess or scientific thinking skills which basically is the development of thinking skills in general, but it leads to activities that are scientific. These skills include skills to identify variables, explaining the relationship a particular phenomenon, formulating hypotheses, designing and conducting research. These skills are integrated into process skills, this is in accordance with the capabilities and concepts underlying fundamental science as process skills. It is known that the ability and fundamental concepts that underlie science as process skills to teach *life skills* such as 1) Identify the questions that can be answered through scientific investigation; 2) design or conduct scientific investigations; 3) Develop descriptions, explanations, predictions and models using evidence; 4) Think logically and critically; 5) Recognize and analyze alternative explanations and predictions.

Based on Table 3.5 aspects of social skills are generally categorized either observed except for the aspects of communicative language use orally (59%) and aspects of communicating with other groups (63%). In accordance with Vygotsky's theory that emphasizes the social aspects of learning in the belief that social interaction with others spur the development of new ideas and enrich the intellectual development of students.

Based on the data, they found aspects of social skills are less well categorized. This is because, in reality, oral communication was not easy to do, let alone English. Often the student is difficult to

accept the opinion of his interlocutor, not because of the content or ideas but because of the manner of delivery that is less pleasing. Therefore we need the ability how to choose your words and how to convey that is easily understood by his interlocutors, besides speaking in English is also not everyone can easily do. Students should develop the ability to be a good listener and appreciate the explanation submitted by other students. Students also should remain open and appreciate the ideas and different explanations, and consider alternative explanations, and students should strive for more learning to speak English.

Aspects of some social skills students gain both categories. This means learning skills-oriented ICT-based packaged process can teach social skills to students. The general condition which is a condition onset of activity on the process skills that students in the class and the social aspects of the open atmosphere that invites students to discuss. Social skills should mastery by students as prospective teachers in junior high or high in accordance with the purpose of the subjects of Biology at the junior / senior high school. Compliance with the demands of the subjects Biology / IPA in SMA / SMP can be used as modelling for prospective teachers to be able to package learning materials that will be facilitated by the students.

Obstacles or problems were found during the learning process most predominantly found was the lack of English language skills of students orally, however, the understanding or the ability of students in written English is better than his verbal ability. Therefore, the evidence described above indicate that ICT-based media can help improve students understanding of abstract concepts into a visual form that is easily understood.

#### 4. Conclusions and suggestions

Based on the analysis, the conclusions that can be drawn from this study are as follows:

- The learning implementation process in the course of *Plant Physiology* to improve *life skills* through ICT-based process skills good category with a value of 97% reliability of the instrument.
- Cognitive learning outcomes of students average product are 76.4 (B + on the number of letters). For the ability of thinking skills(*thinking skills*)and scientific thinking skills(*academic skills*)students after applying the learning device of *Plant Physiology* through ICT-based process skills are respectively 85.7 and 83. That achievement is at A- value for the system font.
- The ability of social skills(*social skills*)students were in grades B to A- except for the ability to use communicative language orally (59% = value C) and the ability to communicate with other groups (63% = C).
- Obstacles encountered in the implementation of learning *Plant Physiology* English language skills of students orally is still inadequate as a provision in communicating effectively in the classroom.

Referring to the findings of the study, then things can be suggested that researchers are as follows:

- Improve English language skills of students of Biology Education International Class S1 to be able to communicate well in the classroom so that learning can take place effectively.
- Learning tools used in the S1 class Biology Education International will become more meaningful in achieving competency achievement indicator of subjects when using ICT-based media in order to bridge the abstract concept becomes easier to follow visually.

#### 5. References

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