

## **Science Process Skillsbased on Science Subjects of Secondary School Students : A Review**

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**Abstract** : Science process skills knowledge is essential if effective learning of science at all levels of education must be achieved. The knowledge of science process skills helps the learner to develop formal thinking ability and thus appreciate the relevance of science in everyday life. The goal of the review of the previous investigation is to present a thematic study of the related research proof and provide direction to more analyser, teachers, and administrators. The sub-topics in this paper are a review of related literature based on science subjects. Some of the research shows that science process skills can be encouraged by using different types of methods, teaching techniques, and some special projects. Some researchers revealed that there is a significant relationship between academic achievement in the basic and integrated science process skills of Biology students and by use of various learning models that empower these skills to improve students' biology. The science process skills teaching approach facilitates students' achievement in chemistry more than regular teaching approaches. Enhance students' performance and contribute to the improvement of teaching and learning of chemistry in secondary schools. This review paper suggests the from researchers are that teachers and schools to improve the science process skills and higher-order thinking abilities possessed by students because these two things support student success. Thus, the review of studies shows the research space in the suitable knowledge and gives direction for further research in the area of science process skills.

**Keywords** : Science process skills, Teaching Approach, Achievement in science subjects etc.

**Introduction** : Some study shows that SPS has been applied in various fields of science subjects, such as biology (Handayani et al., 2018; Lepiyanto, 2014; Suryaningsih, 2017; Wulandari, Masjjudi, & Balqis, 2014), physics (Irwanto, Rohaeti, Widjajanti, & Suyanta, 2017; Nirwana, Nyeneng, & Maharta, 2014; Siswono, 2017; Syafriyansyah, Suyanto, & Nyeneng, 2013), and chemistry (Siska, Kurnia, & Sunarya, 2013). Some researchers mentioned that this SPS can be accommodated when students learn to use inquiry learning (Lati, Supasorn, & Promarak, 2012; Ramadan & Hamidah, 2015; Sahyar & Nst, 2017; Şimşek & Kabapinar, 2010), hands-on learning (Cigrik & Ozkan, 2015; Suryaningsih, 2017; Wulandari et al., 2014), problem-based learning (Sagala, Rahmatsyah, & Simanjuntak, 2017; Tatar & Oktay, 2011; Wahyuni, Indrawati, Sudarti, & Suana, 2017).

The achievement of learning objectives is crucial for students with science process skills, as measured by cognitive learning outcomes (CLO). These outcomes indicate the level of students' concept understanding, which is essential for dealing with everyday challenges. Studies have shown a correlation between students' Science Process Skills (SPS) and CLO in physics learning, but there is still limited research on empowering students' SPS in biology learning with various learning strategies.

Many researches have been carried out by previous researchers considering science process skills with science subjects, demographic variables, and combining two or more variables at a time. The results have been published in research journals such as the International Journal of Science Education, Science Education, and the Journal of Research in Science Teaching. A review of earlier work is followed by a consideration of those aspects of the Indian education system that still need research-based support for improvement. Therefore, it is necessary to study the literature with the main aim to reveal the scope of research on the topic of review of science process skills from 2014 to 2020.

**Methodology** : The flowchart of the research procedure in this study is given below :

<b>1. SELECT A TOPIC</b>
<b>2. SEARCH THE LITERATURE</b>
<b>3. DEVELOP THE ARGUMENT</b>
<b>4. SURVEY THE LITERATURE</b>
<b>5. CRITIQUE THE LITERATURE</b>
<b>6. WRITE THE REVIEW</b>
<b>7. CRITICAL ANALYSIS OF REVIEW</b>
<b>8. CONCLUSION</b>

### Review of Related Literature Based Onscience Subjects :

- Ihejiamaazu and Isaac (2020) conducted a study correlating science process skills knowledge among senior secondary II biology students in Cross River State, Nigeria. The results of the analysis revealed that attitude and class size have a significant correlation with students' science process skills knowledge. However, gender does not significantly influence Biology students' science process skills and knowledge. Based on the findings, it was recommended among others that the government should build more equipped classroom blocks in secondary schools that will reduce crowded class sizes in schools for effective teaching and learning of Biology.
- Ilma et al. (2020) found a significant correlation between science process skills (SPS) and biology cognitive learning outcomes (CLO) in senior high school students. The highest SPS aspect was observed (78.84%), while the highest achievement was achieved in biology CLO (94.23%). The study suggests integrating SPS into learning activities to improve CLO.
- Harahap and Manurung (2019) aimed to study the effect of a blended learning strategy on learning achievement and process skills of students in plant tissue culture. The research employed a quasi-experimental design. The sample comprised 50 Biology students in the semester. The sampling technique employed was cluster random sampling. Based on the results, it can be concluded that the blended learning technique was found to be significantly more effective in enhancing student's learning outcomes and process skills in plant tissue culture as compared to the traditional learning strategy.
- Naimnule and Corebima (2018) investigated the correlation between metacognitive skills and critical thinking skills toward students' process skills in biology learning. They found in his study that there is a correlation between metacognitive skills and critical thinking skills toward the students' process skills through the implementation of the Inquiry learning model, react, and interact. the contributions of metacognitive skills and critical thinking skills toward the students' process skills through the implementation of inquiry, react, and interact learning models are 64,7%, 81,3%, and 72,5% respectively. this indicates that the effective contribution through the react learning model is higher than that through the inquiry and interact learning models.
- Abungu et al. (2014) studied the effect of the science process skills teaching approach (SPSTA) on students' self-concept in chemistry in students studying in secondary schools in the Nyando district of Kenya. The results revealed that the science process skills teaching approach (SPSTA) had a significant effect on students' self-concept in chemistry.
- Kurniawan (2020) conducted a study relationship between science process skills and critical thinking of students in physics subject. The purpose of this study was to see the relationship between the scientific process and the critical thinking skills of Al-Falah Islamic High School Jambi students on pure harmonic motion material. This research shows that the students of class XII MIPA at Al-Falah Islamic High School Jambi have excellent science process skills and good enough critical thinking skills.
- Haryadi and Pujiastuti (2020) aimed to study the effect of physics education technology (PhET) interactive simulation software-based learning on integrated science process skills. Hence it can be concluded that PhET simulation software-based learning significantly improved the students' science process skills.
- Cetin (2018) investigated the effects of simulation-based cooperative learning on students' physics achievements, attitude toward physics, science process skills, and interactive whiteboards. The results of the study revealed that a simulation-based cooperative learning environment positively affected the student's achievement level in physics more than the traditional learning approach but made small differences in students' process skills attitude towards physics and utilization of interactive whiteboards.
- Artun and Temur (2020) investigated the effects of virtual reality-enriched science laboratory activities on pre-service science teachers' science process skills. The increased scores of experimental groups indicated that virtual reality-enriched science lab activities helped improve the process skills in science.
- Cansiz and Sungur's (2015) study on science process skills development found that both inquiry-based and activity-based instruction were effective in improving students' skills. However, the study found that the history of science instruction did not significantly improve the skills of the treatment group.
- Hirca and Necati (2015) conducted a study developing a constructivist proposal for primary teachers to teach science process skills extended by simple science experiments (ESSE). The study revealed that extended simple science experiment is not only easy and enjoyable to engage in science but also useful for teaching and learning Science concepts and science process skills.

## **Critical Analysis of Review in Science Process Skills of Science Subject :**

### **Similarities :**

**Correlational Focus:** The studies share a common strength in focusing on correlations between various factors and students' science process skills. They identify relationships between variables such as attitude, class size, metacognitive skills, critical thinking, and teaching approaches.

**Advocacy for Educational Strategies:** Each study advocates for specific educational strategies or interventions to enhance science process skills. These strategies include building more classrooms, integrating science process skills into learning activities, using blended learning, implementing inquiry-based learning models, employing science process skills teaching approaches, and incorporating simulation software or virtual reality.

**Empirical Evidence :** All studies provide empirical evidence to support their findings. They present data and statistical analyses to demonstrate the relationships between different variables and science process skills.

### **Limitations :**

**Causation vs. Correlation:** A common limitation in these studies is the focus on correlation rather than establishing causation. While they identify relationships between variables and science process skills, they often do not delve deeply into the underlying mechanisms or reasons for these correlations.

**Limited Generalizability :** Some studies focus on specific topics or contexts, potentially limiting the generalizability of their findings. For instance, a study concentrating on a particular physics topic may not be broadly applicable to other physics topics or scientific disciplines.

**Assumption of Direct Links :** In some studies, there's an assumption of direct links between certain factors and improvements in science process skills. For instance, recommending the construction of more classrooms assumes a direct link between reduced class size and enhanced skills, without considering potential confounding variables.

**Insufficient Exploration of Negative Findings :** A few studies do not extensively explore negative findings or aspects that did not significantly contribute to skill improvement. For example, the study on the history of science instruction does not delve into why it did not significantly improve skills in the treatment group.

**Scalability Concerns :** The scalability of proposed approaches or interventions is a limitation in some studies. The potential challenges or feasibility issues related to implementing these interventions on a larger scale or in different educational settings are not thoroughly addressed.

**Suggestions based on Reviews :** Suggestions from researchers are that teachers and schools to improve the science process skills and higher-order thinking abilities possessed by students because these two things support student success.

The Basic Education Office should continue to make efforts to improve the professionalism of elementary teachers, for example in the form of training, workshops, seminars, and so on (especially in science lessons) So that every teacher has skills in teaching science. Primary school principals/scientists, it should: further improve their professional skills to improve the quality of science learning and provide more motivation to learn to the students to stimulate learning creativity (especially science lessons).

**Conclusion :** The study found that science process skilled knowledge has no significant difference between students' genders but has a positive correlation with student attitude and class size. Metacognitive skills and critical thinking skills contribute to process skills through the implementation of inquiry, REACT, and INREACT learning models. Biology students perform average academically in basic and integrated science processes, with year level and gender not affecting their performance. Integrating science process skills into learning activities using various models can improve students' understanding of biological concepts. The study also found a significant positive relationship between science process skills and high-level thinking skills. The study suggests that more emphasis should be placed on developing process skills like observation, classification, drawing inference, and interpreting data.

Thus, effective planning is needed to take place in the school to improve science teaching and learning quality.

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