Universitas: Journal of Global Research and Innovation
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A Comparative Analysis of the Science Process Skills of Academically at-Risk Entry-Level and Exit-Level Junior High School Learners

Maria Niña P. Jalbuna
Iloilo State University of Fisheries Science and Technology
https://doi.org/10.5281/zenodo.24081226

ABSTRACT

This study assessed and compared the science process skills of academically at-risk learners at the entry and exit levels of junior high school. It aimed to determine the proficiency level of the basic and integrated process skills of learners and the significant differences between the two groups. A quantitative approach using a descriptive comparative research design was employed. Purposive sampling was utilized to identify and select the participants based on the established criteria of academic risk. The participants in the study were the twenty-nine (29) Grade 7 learners who are at the entry level and twenty-three (23) Grade 10 learners at the exit level of junior high school. The data were gathered using a validated researcher-developed instrument. Descriptive statistics indicated that academically at-risk learners at the entry level achieved the highest mean score and mean percentage in inferring, which was classified as moderately developed, while they showed the least development in identifying variables and other science process skills. For the exit level, the results indicated that learners achieved similar outcomes in defining variables, inferring, and formulating hypotheses, all of which are categorized as underdeveloped skills. The Mann-Whitney U test also revealed significant differences between the two groups in terms of observing, interpreting data, and designing investigations. The overall findings revealed that both learners from the entry and exit levels displayed low proficiency in basic and integrated process skills. The findings of the study highlight the continuing learning gaps among academically at-risk learners across grade levels. Therefore, targeted instructional interventions are deemed necessary to address these deficiencies and improve learners' performance in science.

Keywords: *academically at-risk learners, basic science process skills, integrated science process skills, entry level, exit level, intervention*

INTRODUCTION

Science education is important in enhancing the ability of learners to investigate evidence, explain natural phenomena, solve problems, and make rational judgement. Learners are expected to engage in scientific investigation thru observing, classifying, measuring, predicting, inferring, communicating, formulating hypotheses, identifying variables, interpreting data, and drawing conclusion aside from acquiring scientific facts and concepts. In the Philippines, science curriculum supports the development of these science process skills competencies through scientific investigation to a more complicated science concepts across grade levels. The Department of Education ensures that the science process skills are integrated into the instructional resources prepared for teachers and learners (Department of Education [DepEd], n.d.).

Science process skills (SPS) are fundamental competencies that enable learners to actively participate in scientific inquiry by gathering, organizing, analyzing, and interpreting information to explain phenomena, solve problems, make predictions, and understand scientific concepts (Gizaw & Sota, 2023). They are commonly grouped into two categories: basic science process skills and integrated science process skills. Basic science process skills include observing, classifying, measuring, making inferences, predicting, communicating, and using the relation of space and time. On the other hand, integrated science process skills consist of interpreting data, operational definition, controlling variables, making hypotheses, and experimenting (Fajardo, 2023). These skills enable learners to obtain scientific knowledge through systematic investigation instead of just memorizing concepts or information. The basic science process skills include observing, classifying, measuring, predicting, inferring, and communicating. On the other hand, the integrated process skills involve formulating hypotheses, identifying and controlling variables, designing investigations, experimenting, analyzing or interpreting the data, and making conclusions. These skills are related to the conceptual understanding of learners in connecting scientific ideas with observations and evidence. The science process skills of the junior high school learners are connected to their understanding of the concepts presented, which is vital in meaningful science learning (Tan et al., 2020).

As the educational systems around the world started to incorporate competency-based and inquiry-centered approaches to teaching instructions to produce more globally competitive individuals, it also highlighted the importance of science process skills. In addition, the Program for International Student Assessment (PISA) emphasizes that science process skills serve as the foundational competencies to develop and engage learners in scientific inquiry, critical thinking, and logical reasoning to meet the twenty-first century (Organisation for Economic Co-operation and Development [OECD], 2023). However, despite the several

changes in the curriculum to mitigate problems associated with the very low performance of Filipino learners in science, the Philippines still ranked as one of the poorest-performing countries in science, with only about twenty-two percent (22%) achieving science literacy scores at Level 2 or higher during its first participation in PISA in 2018 (Bernardo et al., 2023). Similar results were also observed in 2022, in which only 23% of learners reached Level 2 or higher in science (OECD average: 76%) (OECD, 2023). The learners at this level of proficiency can apply basic scientific knowledge to explain phenomena encountered in familiar situations and interpret simple sets of scientific data. This proficiency level is regarded as the baseline for demonstrating science literacy. This revealed that Filipino learners are very poor in science literacy and have difficulties in applying scientific knowledge, evaluating evidence, and solving scientific problems. This indicates the importance of improving science instruction by focusing not only on content mastery but also on the development of inquiry skills and scientific reasoning.

Moreover, these problems in science literacy are very evident among academically at-risk learners. These groups of learners who are considered at-risk have lower levels of skills, knowledge, motivation, or academic ability and most likely do not meet the expected outcome required. Furthermore, they are often in need of additional support and intervention to succeed academically (Davison et al., 2024). Although some factors like socioeconomic status, study habits, motivation, learning resources, and family support may contribute to their performance in school. The schools' curriculum content and classroom instructions couldn't be the sole contributors to the Filipino learner's low performance in science; instead, it is also affected by other factors like metacognition strategies, motivation, school experiences, family conditions, and access to learning resources (Calleja et al., 2023).

Since the entry and exit levels of junior high school are crucial stages in a learner's cognitive progress in science education, it is important to examine the skills developed by the academically at-risk learners at this level. At these stages' learners encounter more complex scientific concepts and are expected to participate in inquiry-based investigations while developing essential science process skills. Evaluating learners at these two levels provides substantial evidence of the progress of their attainment of foundational competencies, which is vital for their future learning. Hence, comparing the science process skills of both the entry and exit levels can help identify their proficiency in basic and integrated science process skills.

Moreover, examining the skills that they already mastered and the areas of difficulty is important so that teachers and curriculum planners can provide remediation and design supplemental activities that can help enhance their science literacy development. This

study aims to assess and compare the science process skills of academically at-risk learners at the entry and exit levels of junior high school and determine which skills need further improvement. The findings of this study could be used to develop instructional support and learning materials that are appropriate to the learning needs of the academically at-risk learners.

METHODOLOGY

The study employed quantitative approach using the descriptive-comparative research design to assess and compare the proficiency levels in the science process skills of academically at-risk learners at the entry and exit levels of junior high school at Tigbauan National High School. The entry level refers to Grade 7 which is the beginning of junior high school, while the exit level refers to Grade 10 which is the final year of learners in junior high school.

Purposive sampling was utilized in selecting the participants in the study based on school indicator criteria for academic at-risk. The participants consisted of twenty-nine (29) Grade 7 learners and twenty-three (23) Grade 10 learners who are identified as academically at risk.

The instrument used in the study was a researcher-developed assessment. The test consisted of a total of 60 multiple-choice items. The test items were divided into two parts. Item numbers 1 to 30 were composed of 30 items for basic science process skills, which are observing, classifying, measuring, communicating, inferring, and predicting, with five questions assigned in each skill. Likewise, items numbered from 31 to 60 comprised another 30 items for integrated science process skills, which included identifying variables, formulating hypotheses, defining variables operationally, interpreting data, designing investigations, and drawing conclusions.

The instrument underwent expert validation to ensure its accuracy, relevance, and appropriateness in the study. A reliability test was also performed to determine internal consistency. The results showed that a Cronbach's alpha coefficient of 0.755 was obtained, which means that the instrument indicated an acceptable level of consistency. Before administering the test, the researcher obtained the necessary permit from the school, informed consent from the participants, and parental consent from their parents or guardians.

After the data was gathered, it was analyzed using descriptive and inferential statistics. The descriptive statistics were used to assess the levels of science process skills of academically at-risk learners. They included the mean, standard deviation, and mean percentage. The mean percentage results were interpreted as follows: below 60%—beginning; 60-69%—developing; 70-79%—moderately developed; 80-89%—developed; and 90-100%—highly developed. For inferential statistics, the Mann-Whitney U test was used to determine significant differences in the science process skills between the entry and exit levels of academically at-risk learners in junior high school.

RESULTS AND DISCUSSION

This section presents the findings and interpretations of the comparative analysis of the science process skills of academically at-risk learners between the entry level and exit level in junior high school.

Table 1. Descriptive statistics of the science process skills of academically at-risk learners at the entry level

					Shapiro-Wilk	
	N	Mean	MPS	SD	W	p
Observing	29	1.76	35.17	0.988	0.871	.002
Classifying	29	2.03	40.69	1.180	0.910	.018
Measuring	29	2.00	40.00	1.195	0.924	.038
Communicating	29	1.97	39.31	1.085	0.903	.011
Inferring	29	3.59	71.72	1.701	0.795	<.001
Predicting	29	1.72	34.48	1.099	0.860	.001
Basic_SPS	29	13.07	43.56	3.184	0.960	.323
Identifying variables	29	1.62	32.41	1.049	0.856	.001
Formulating Hypothesis	29	3.45	68.97	1.454	0.852	<.001
Defining variables	29	2.86	57.24	1.684	0.896	.008
Interpreting data	29	1.72	34.48	1.099	0.914	.022
Designing Investigation	29	3.10	62.07	1.047	0.791	<.001
Drawing Conclusion	29	2.69	53.79	1.491	0.853	<.001

	N	Mean	MPS	SD	W	p
Integrated_SPS	29	15.45	51.49	4.298	0.953	.222
Overall_SPS	29	28.52	47.53	6.254	0.944	.129

The results of the descriptive statistics on the basic science process skills revealed that the learners obtained the lowest mean score in predicting (M = 1.72, SD = 1.099) with a Mean Percentage Score (MPS) of 34.48, followed by observing (M = 1.76, SD = 0.988) with an MPS of 35.17, and communicating (M = 1.97, SD = 1.085) with an MPS of 39.31. The results also showed that there is a moderate degree of variation in the scores of learners. This suggests that the learners had difficulties in anticipating possible results based on evidence and sharing their scientific findings with others. Since predicting as a basic science process skill also requires prior understanding and better logical analysis, weaknesses in these areas can greatly affect how they present and make evidence-based assumptions. While inferring, it recorded the highest mean score (M = 3.59, SD = 1.701) with a corresponding MPS of 71.72. However, the results indicated that there was a high degree of variation in the individual learners' scores in this skill. This indicates that some learners may know about formulating reasonable explanations based on their observation and prior knowledge, while others are still struggling in this area. In addition, the data analysis revealed that inferring was the strength of academically at-risk learners at the entry level and was considered a moderately developed scientific process skill. This suggests that the learners were able to connect their prior knowledge and experiences in formulating logical explanations, as it is important in activating learners' understanding of new concepts (Belouiza et al., 2024). Moreover, the learner's attainment in inferring skills may also be influenced by how their science teacher provides them with instructional activities that could help improve their inferring skills (Salanatin, 2020). However, the findings of the study still do not show that the learners have attained a level of mastery in making justifiable interpretations based on their prior knowledge, experiences, and observations.

In terms of integrated science process skills, the results indicated that the learners attained the highest mean score in formulating hypotheses (M = 3.45, SD = 1.684) with an MPS of 68.97, followed by designing investigations (M = 3.10, SD = 1.047), which obtained an equivalent MPS of 62. The results indicated that there is some development in the skills of learners in formulating hypotheses and designing investigations, although they remained within the developing proficiency category. The findings of the study imply that despite the difficulties encountered by learners in reading and understanding what they have read, they were still able to use their previous ideas and experiences to connect with the new knowledge introduced to them. This highlights the role of activating prior knowledge in

generating hypothesis concepts (Belouiza et al., 2024). These findings might be associated with the learners' performance in inferring, their ability to reason logically, and their acquired understanding of the concepts.

In addition, the results revealed that identifying variables was the weakest skill of the learners at the entry level, with the lowest mean score (M=1.62, SD=1.049), an MPS of 32.41, and was categorized under the beginning level of proficiency. The results also displayed variation in the individual scores of learners under integrated science process skills, demonstrating that their performance in these areas was inconsistent. Likewise, all other science process skills such as observing, classifying, measuring, communicating, predicting, defining variables, interpreting data, and drawing conclusions were interpreted as being in the beginning proficiency category. The overall data analysis revealed that the academically at-risk learners at the entry level continued to demonstrate the lowest proficiency in the science process skills. The findings suggest that the learners' poor performance might be affected by their limited reading comprehension and insufficient conceptual understanding of the topic.

Generally, the results demonstrated that the integrated process skills of learners at the entry level were slightly higher (M=15.45, SD=4.298), with a mean percentage score of 51.49, compared to the basic process skills (M=13.07, SD=3.184), with a mean percentage score of 46.56. This finding suggests that the learner's activities in the classroom could be influenced by their classroom experiences and exposure to instructional activities. Furthermore, the overall science process skills of the academically at-risk learners at the entry level indicated a mean score of 28.52 with an MPS of 47.53. The findings of the study suggest that the academically at-risk learners at the entry level of junior high school generally had not yet achieved the proficiency level expected of them. Many learners exhibit low performance in most of the basic science process skills and also highlight their limited abilities and conceptual understanding of the science inquiry processes. A learner's insufficient conceptual understanding of foundational science skills can be attributed to low literacy and reading comprehension, which affect their ability to describe, process, and express ideas (Buban, 2023.). If this learning gap is not addressed properly, it could affect the scientific literacy of the learners since the basic science process skills serve as the foundation for understanding more complex ideas.

Table 2. Descriptive statistics of the science process skills of academically at-risk learners at the exit level

					Shapiro-Wilk	
	N	Mean	MPS	SD	W	p
Observing	23	2.57	51.3	1.273	0.860	.004
Classifying	23	2.65	53.04	0.885	0.832	.001
Measuring	23	2.61	52.17	1.305	0.907	.036
Communicating	23	2.43	48.7	1.080	0.901	.027
Inferring	23	3.30	66.09	1.690	0.851	.003
Predicting	23	2.30	46.09	1.490	0.942	.197
Basic_SPS	23	15.87	52.90	4.434	0.949	.274
Identifying Variables	23	2.26	45.22	1.251	0.944	.222
Formulating Hypothesis	23	3.13	62.61	1.740	0.874	.008
Defining Variables	23	3.35	66.96	1.465	0.867	.006
Interpreting Data	23	2.52	50.43	1.275	0.938	.165
Designing investigation	23	2.17	43.48	1.497	0.874	.008
Drawing Conclusion	23	2.35	46.96	1.301	0.899	.024
Integrated_SPS	23	15.78	52.61	5.681	0.943	.211
Overall_SPS	23	31.65	52.75	8.574	0.977	.846

The results of the descriptive analysis of the science process skills of academically at-risk learners at the exit level showed that predicting obtained the lowest mean score (M = 2.30, SD = 1.490) with a Mean Percentage Score (MPS) of 46.09, followed by communicating (M = 2.43, SD = 1.080) with an MPS of 48.7. Inferring, however, obtained the highest mean score (M=3.30, SD=1.690) and an MPS of 66.09. The results also revealed that the scores of the learners in the basic process skills indicated a moderate to high degree of variation in the individual scores of learners. Generally, the overall basic science process skills of the learners obtained a mean score of 15.87 and an MPS of 52.90. The findings of the study revealed that academically at-risk learners at the exit level encountered the same difficulties in terms of basic science process skills as the learners at the entry level. The

results indicate that there are ongoing academic challenges affecting the learning progress of learners that are not properly addressed as they advance to higher grade levels. These academic challenges may include learning gaps, difficulties in comprehension, lack of motivation, and other factors that impede learners from acquiring enough knowledge and skills during the teaching-learning process. Without proper intervention, learners may continue to experience academic difficulties, which can affect their learning and prevent them from improving their academic performance (Canillo et al., 2024).

Meanwhile, the descriptive analysis of integrated process skills revealed that learners got the lowest mean score in designing an investigation (M=2.17, SD=1.497) with an MPS of 43.48. The findings suggest that academically challenged learners at the exit level have not yet achieved the competencies in designing an investigation compared to the learners at the entry level. While defining variables, they recorded the highest mean score (M=3.35, SD=1.465) with an MPS of 66.96 and were categorized as a developing skill. In addition, formulating a hypothesis (M = 3.13, SD = 1.740) ranked second in terms of mean score but had a high degree of variability. This finding indicates that several learners acquired some fundamental understanding of the concepts; however, they still need continued instructional support to improve their understanding.

Lastly, the overall performance of the process skills of academically at-risk learners at the exit level, both the basic science process skills (MPS = 52.90) and the integrated science process skills (MPS = 52.61), was categorized as beginning. The study also revealed that the overall MPS was recorded as 52.75, which remained at the beginning level of proficiency. Though the data showed that the performance of academically at-risk learners at the exit level is slightly higher than that at the entry level, they both remain within the beginning category, which means they fail to develop essential skills necessary for achieving science literacy. The extremely low performance of learners at the exit level is an indication that the learners have not sufficiently developed and mastered scientific skills throughout their progression from the beginning toward the end of their junior high school. Since science process skills develop systematically, they require constant practice through inquiry-based instruction and laboratory activities. When learners are exposed to meaningful science instruction and laboratory hands-on materials, their science process skills also greatly improve (Rivera & Manalastas, 2025).

Table 3. Mann-Whitney U Test for Comparisons of the Science Process Skills of Academically At-Risk Learners at the Entry and Exit Levels of Junior High School

	Statistic	p	Effect Size
Observing	213	.022	0.3628
Classifying	240	.072	0.2804
Measuring	230	.050	0.3118
Communicating	252	.117	0.2459
Inferring	298	.495	-0.1079
Predicting	253	.128	0.2414
Identifying Variables	239	.072	0.2834
Formulating Hypothesis	306	.610	-0.0825
Defining Variables	280	.315	0.1619
Interpreting Data	209	.018	0.3748
Designing investigation	214	.022	-0.3598
Drawing Conclusion	279	.302	-0.1649

The inferential statistics using the Mann-Whitney U test revealed that in terms of observing ($U = 213$, $p = 0.022$; $rrb = .363$), interpreting data ($U = 209$, $p = .018$, $rrb = 0.375$), and designing investigations ($U = 214$, $p = .022$, $rrb = .360$) there was statistically significant differences ($p < 0.05$) between the levels of science process skills assessment of academically at-risk learners at the entry and exit level. The rank biserial correlation also indicated moderate effect sizes, which means that the differences between the two groups in these science process skills are practically important. The findings suggest that learners from the two grade levels exhibited noticeable differences in the science process skills that require careful examination of scientific phenomena, analyzing the data, and their capacity to develop appropriate investigation plans.

On the other hand, there were no statistically significant differences ($p > .05$) observed in other science process skills such as classifying, measuring, communicating, inferring, predicting, identifying variables, formulating hypotheses, defining variables, and drawing conclusions. The findings of the study revealed that the academically at-risk learners at the entry and exit level of junior high school demonstrated similar performance in most science process skills. This signifies that advancement to the next grade level is not a guarantee that learners have already mastered the learning competencies introduced to them across different academic levels. The findings may be associated with the similarities in the academic status of the two groups, where they were both classified as academically at-risk learners. These learners are often described as having prolonged learning difficulties, low academic performance, limited involvement in learning activities due to frequent absences, and lack of eagerness to learn (Larose & Tarabulsy, 2014). Factors associated with these challenges included socioeconomic status, lack of parental support, emotional and cognitive barriers, and underdeveloped literacy and numeracy abilities. These learning difficulties accumulate and persist over time throughout junior high school if appropriate remedial measures and interventions are not implemented (Ferreras & Astillero, 2025).

CONCLUSION

This study assessed and compared the science process skills of academically at-risk learners at the entry and exit levels of junior high school. The overall findings indicated that academically at-risk learners at both levels have underdeveloped science process skills. However, the findings revealed that inferring was considered the most developed among other science process skills at both levels. Identifying variables was shown to be the least developed skill of academically at-risk learners

The results also indicated significant differences between entry level and exit level in terms of observing, interpreting data, and designing investigations. Learners at the exit level showed better performance in observing and interpreting data, whereas learners at the entry level attained higher scores in designing investigations.

The findings of the study suggested that both academically at-risk learners at the entry and exit levels of junior high school need consistent and strategically designed instruction that can support their identified learning needs. Furthermore, it is important that science teachers carefully plan and design interventions and remediations to address the persistent learning gaps in science education.

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