



Ethnical Diversity in the Pilot Cadets Education: Study at Banyuwangi Indonesian Aviation Academy

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ABSTRACT

Pilot cadets take part in a series of education and training at an academy. Differences in the background of prospective cadets can affect the educational process and achievements achieved by the cadets. This study aims to analyze differences in the area of origin of the education and training outcomes of prospective pilot cadets. The study was conducted on 22 cadets of the Indonesian Aviation Academy Banyuwangi which were divided into 3 groups of regions of origin which generally had different levels of educational progress. The scores of the initial test results including the academic potential test, physical test and initial flight aptitude test were compared. Furthermore, comparisons were made for the initial flight aptitude test, flight aptitude test 1 and flight aptitude test 2. The results showed that education and training at the academy could improve the performance of the cadets but still resulted in achievement gaps due to their regional background. The results of the study can be used as a reference for the development of pilot education models. Further research can be done for deeper diversity or educational curriculum that is not yet optimal

INTRODUCTION

The rapid growth of global airlines in recent years has sparked an increasing demand for talented pilots to join the aviation industry (Valenta, 2018). Overall the world needs 200,000 pilots in 2018 (International Civil Aviation Organization (ICAO)). However, the process of obtaining a competency certificate as a pilot requires a high cost (FTEJerez, 2019). These conditions have encouraged pilot training and recruitment institutions to seek to improve training efficiency at an affordable cost but able to meet the standard needs of the aviation industry (Adanov et al., 2020). A pilot training report provides an overview of demographic differences in attrition rates, reasons for attrition, and an analysis of whether certain individual characteristics (e.g., test scores, prior flying experience) can account for differential rates of attrition (Schulker et al., 2018).

A pilot's work involves information processing operations that typically occur in real-world contexts when unexpected events occur: paying attention, diagnosing, and responding (Wickens et al., 2009). An aircraft cockpit system is an example of a complex human-in-the-loop system (Chen et al., 2021). The pilot's workload as perceived by the pilot can be studied based on the movement of the control inceptor which is manifested in the form of sticks and wheels (Babu, 2022). The development of the aviation industry fuels training effectiveness by working in the same way as real aircraft maneuverability (Jo & Kwon, 2017). The process of establishing a flight school organization in Indonesia is part of an effort to meet the needs of aviation human resources, especially pilots. However, of the 17 existing aviation high schools, there are still not enough human resources or experts to supply every existing airline.

On the other hand, even though the compensation received by pilots of national airlines is currently smaller than when working for foreign airlines (Parkhimovich, 2019). However, competition with foreign pilots still often occurs due to the urgent need for pilots (Banuara & Purba, 2018). The Indonesian Aviation Academy Banyuwangi is one of the flight education providers under the Ministry of Transportation's Human Resources Development Agency from 7 flight schools in Indonesia. The academy has the duty and function to educate cadets to become professional and skilled human resources in the field of aviation in accordance with national and international regulations. The academy has education programs for Fixed Wing Pilots and Aircraft Operations (API Banyuwangi (a), 2022). These two programs are expected to anticipate future human resource needs in the air transportation sector.

The Indonesian Aviation Academy Banyuwangi education and training curriculum refers to national (Ministry of National Education) and international (ICAO) standards (API Banyuwangi (b), 2019). A prospective cadet must go through a series of selection processes and tests to become a cadet pilot at an aviation school (Adanov et al., 2020; Carretta & Ree, 2000; IATA, 2019). The results of selection and tests can be used as qualification standards that will determine the education and training process for cadets. The background of prospective cadets from the aspect of education (UCAS, 2022), ethnicity or area of origin and prior knowledge (Rony & Siddique, 2020), are factors that can affect the qualifications of a prospective cadet (Adanov et al., 2020). Meanwhile, the issue of widespread ethnic and racial disparities in education is often found to be under performing academically (Quintana et al., 2012). This is also one of the obstacles that are often found in education programs at pilot cadet schools (Schulker et al., 2018). So in improving the optimal cadet graduation standards, a qualification model is needed that can provide the right justification for qualifying a prospective cadet, especially in Indonesian Aviation Academy Banyuwangi.

Education serves society by providing practical knowledge and guiding talents while directing attention to values and worldviews (Zhang, 2019). Minority students tend to have higher aspirations, given the characteristics of their socioeconomic background, education or region of origin (Gil-hernández et al., 2018). Schools that have students from different ethnic groups provide space and opportunities for students to interact socially between groups (Ahmad et al., 2018). Characteristics of students, regions of origin, and ethnic backgrounds, can be the basic foundation for pedagogic development (Mel, 2021). Increasing ethnic diversity in learning has the potential to improve the learning experience and educational attainment of minority students (Villegas et al., 2012). The proportion of immigrant students or minority groups in a class is negatively related to the academic performance of the local group (Veerman et al., 2013). Students' learning environment at home and school as well as basic skills have an important role in the learning process (Sonnenschein & Galindo, 2015). Multicultural symbiosis has a pattern in the perspective of interaction, communication and accommodation (Dazhong, 2014). The influence of educational curricula and learning practices strongly supports positive social identity in the classroom and in various subjects (Bonilla et al., 2021).

Policy documents that identified in a research, particularly in relation to student diversity, are not likely enablers for the creation of inclusive learning environments (Messiou et al., 2022). Identification of the diversity of students is often an important point that teachers rarely consider before the learning is carried out. In fact, by understanding this diversity, teachers can undoubtedly carry out adaptive learning and

assessments that are suitable for the conditions of students (Ramdani et al., 2022). Around 40% of the teachers repudiated the influence of diversity on student achievement and did not take student diversity into account in their teaching practice (van Middelkoop et al., 2017). Diversity on higher education has played a key part in and remains at the forefront of national debates regarding diversity efforts, and is a uniquely important institution in its ubiquity and impact on individuals' life outcomes (Starck et al., 2021). The type and quality of each faculty practice or measure of interaction with students may be significant in terms of fostering positive diversity attitudes among students (Trolan & Parker, 2022).

Pilot education and training also faced with cadets diversity problem. Diversity in pilot education, among others, has been studied for minorities in aviation (Ison et al., 2016), diversity policy (Morrison, 2019), racial diversity in aviation (Stevenson et al., 2020) and aviation communication (Bush, 2021). Gender diversity in aviation also studied for women role in aviation such as women representation in commercial aviation (Ferla & Graham, 2019) and women in aviation (Lutte, 2021). Ethnical diversity among pilot cadets has not been reported. The development of qualification models in pilot training academies has been widely studied, among others, as a predictive model for prospective pilots in loyalty, obedience, precision, ethics, motivation or commonly called professionalism (IATA, 2019), progressive measurement of pilot abilities during training (Jirgl et al., 2016) and aeronautics program (Experimental Aircraft Association, 2020). The qualification model becomes an applicable measuring tool that can facilitate the selection process and the formation of pilot cadets in Indonesia in particularly in Indonesian Aviation Academy Banyuwangi. This study aims to analyze ethnical diversity in the pilot cadets education as a study at Banyuwangi Indonesia Aviation Academy.

RESEARCH METHOD

The research was conducted based on the following mind frame in Figure 1.

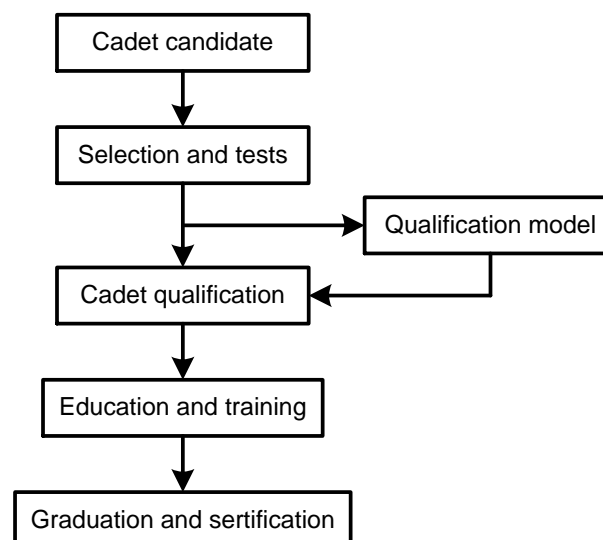


Figure 1. Research mind frame

Prospective pilot cadets in Indonesian Aviation Academy Banyuwangi take part in a physical selection, including a minimum height of 167 cm (male) and 165 cm (female)

with an ideal body weight. Health tests are laboratory tests including blood, urine, radiology, electro-cardiography and audiometry tests. Physical ability tests are 12 minutes of running (distance achieved in meters), 1 minute of push ups (achievement), 1 minute of sit ups (achievement) and 3 rounds of shuttle run (time in seconds). The selection process determines whether a prospective cadet has met the basic criteria or not to be able to take part in the test process. In addition, also take the test:

1. Academic test, namely the academic potential test covering mathematics, physics and English.
2. Psychological tests (IQ tests).
3. Flying aptitude test using a simulator for aptitude test.

Passing the test process is carried out with an assessment where the academic test weighs 60%, the physical test weighs 25% and the flight aptitude test weighs 15%. The analysis was conducted on 22 cadets of the Banyuwangi Indonesian Aviation Academy. The background of regional origin is divided into 3 according to the territory of Indonesia which generally has different levels of progress in the field of education, namely group I, namely the island of Java, group II, namely outside Java island (Sumatera, Kalimantan, Sulawesi and Bali) and group III, namely Eastern Indonesia (Papua, Maluku and Nusa Tenggara). The areas of origin for group I generally have a more advanced education pattern than group II and then group III. The cadets who were the research subjects in group I were subjects 1 to 9 (9 people), group II was subjects 10 to 16 (7 people) and group III was subjects 17 to 22 (6 people).

The analysis was carried out by comparing the data from the initial test results with the stage flight aptitude test and the stage flight aptitude test. The flight aptitude test is a stage and is a series of tests with a flight simulator and practice in the form of an aptitude test. This comparison is a form of changes in cadet test results from the beginning to the stage after receiving education and training. The results of the comparison are used as an analysis material for the education and training cycle as a form of curriculum implementation at Banyuwangi Indonesian Aviation Academy.

The flight aptitude test is a series of aptitude tests including section 1 (straight and level), section 2 (rate and turn), section 3 (climb) and section 4 (descend). The assessment scores in this test are A = 3, B = 2 and C = 1. The final score is determined by the following equation:

$$\text{Final score} = \left(\frac{\text{Sec 1}}{4} + \frac{\text{Sec 2}}{5} + \frac{\text{Sec 3}}{7} + \frac{\text{Sec 4}}{7} \right) \times \frac{100}{12} \quad (1)$$

Sec	Exercise	A	B	C
1	Straight-and-Level:			
	a) Altitude	<input type="checkbox"/> 0-100	<input type="checkbox"/> 100-200	<input type="checkbox"/> > 200
	b) Heading	<input type="checkbox"/> 0-10°	<input type="checkbox"/> 10-20°	<input type="checkbox"/> > 20°
	c) Power Setting	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
2	d) Handling	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	Rate One Turn:			
	a) Clearing turn	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	b) Start Turn	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	c) Come Out Heading	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
3	d) Altitude	<input type="checkbox"/> 0-100	<input type="checkbox"/> 100-200	<input type="checkbox"/> > 200
	e) Handling	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	Climb:			
	a) Climb Speed	<input type="checkbox"/> ±5 Kts	<input type="checkbox"/> ±10 Kts	<input type="checkbox"/> ±15 Kts
	b) Power Setting	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	c) Nose Attitude	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	d) Heading	<input type="checkbox"/> 0-10°	<input type="checkbox"/> 10-20°	<input type="checkbox"/> > 20°
4	e) Altitude	<input type="checkbox"/> 0-100	<input type="checkbox"/> 100-200	<input type="checkbox"/> > 200
	f) Climbing Turn	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	g) Handling	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	Descend:			
	a) Rate of Descend	<input type="checkbox"/> ±100 ft/m	<input type="checkbox"/> ±200 ft/m	<input type="checkbox"/> ±300 ft/m
	b) Power Setting	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	c) Nose Attitude	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	d) Heading	<input type="checkbox"/> 0-10°	<input type="checkbox"/> 10-20°	<input type="checkbox"/> > 20°
	e) Altitude	<input type="checkbox"/> 0-100	<input type="checkbox"/> 100-200	<input type="checkbox"/> > 200
	f) Descending Turn	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr
	g) Handling	<input type="checkbox"/> Correct	<input type="checkbox"/> Inc.Res	<input type="checkbox"/> Inc.Unr

Figure 2. Aptitude test form

RESULTS AND DISCUSSION

The data for the initial test results of 22 cadets are shown in table 1 and the comparison data for the flight aptitude test is shown in Table 2.

Table 1. Initial test.

Subject	Academic test	Physical test	Initial aptitude test	Test score
1	73.33	47.50	56.24	64.3
2	68.00	34.50	64.31	59.1
3	62.00	61.00	71.56	63.2
4	58.67	38.50	64.28	54.5
5	57.33	38.00	64.92	53.6
6	48.54	59.83	71.65	54.8
7	52.10	47.25	76.12	54.5
8	48.67	42.83	52.47	47.8
9	47.33	56.33	53.14	50.5
10	48.67	49.66	56.26	50.1
11	37.33	32.16	68.25	40.7
12	29.33	31.16	61.94	34.7
13	25.33	30.33	57.14	31.4
14	27.59	54.00	61.24	39.2
15	32.54	56.17	63.84	43.1
16	46.12	46.50	70.26	49.8
17	42.10	66.33	72.46	52.7
18	38.64	39.50	75.00	44.3

Subject	Academic test	Physical test	Initial aptitude test	Test score
19	45.26	41.83	55.42	45.9
20	47.21	54.50	63.33	51.5
21	34.92	43.83	55.42	40.2
22	51.26	54.17	53.33	52.3
Average	46.47	46.63	63.12	49.01

Table 2. Aptitude test comparison.

Subject	Initial aptitude test	1st aptitude test	2nd aptitude test
1	56.24	67.24	97.50
2	64.31	76.00	97.60
3	71.56	85.83	96.30
4	64.28	76.83	95.90
5	64.92	76.30	90.60
6	71.65	86.00	92.60
7	76.12	84.00	92.70
8	52.47	85.20	86.10
9	53.14	82.15	89.90
10	56.26	77.00	91.70
11	68.25	72.00	93.10
12	61.94	79.50	86.70
13	57.14	72.90	86.00
14	61.24	71.60	80.00
15	63.84	67.50	76.00
16	70.26	74.50	89.00
17	72.46	77.10	83.00
18	75.00	74.60	84.50
19	55.42	69.70	93.90
20	63.33	75.00	82.50
21	55.42	67.50	88.24
22	53.33	73.20	86.00

The data in tables 1 and 2 are shown in graphical form in Figures 3 and 4.

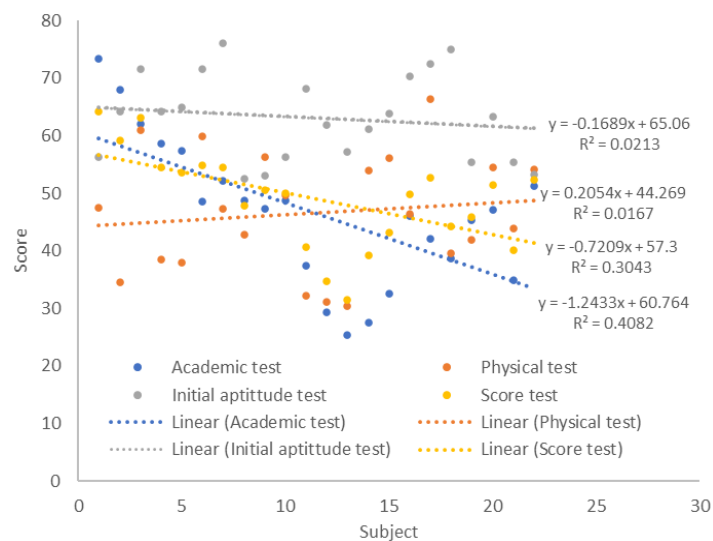


Figure 3. Initial test

Figure 3 shows the scores for the academic test, physical test and flight aptitude test when prospective cadets register. The results of this test are cadets who are considered eligible to take part in education and training at the Indonesian Aviation Academy Banyuwangi. The graph shows the level of distribution of the data which is relatively random. This shows that in terms of academic, physical and flying talent, the cadets have various levels. This happens because the cadets have different backgrounds, ethnicities and educational models. The test results show a relatively wide range of values. This test is an initial measurement of the condition of prospective cadets, one of which contains academic material from education (high school). This difference is very likely due to ethnic differences with nasal regions that have different levels of educational development. The difference score caused by ethnic diversity is a representation of minority groups, although the participation rate has shown an increase in the last two decades (Ison et al., 2016). The graph shows the test results which are relatively distributed with a relatively large range of values, the difference is very visible in the aspect of flying talent. This gap is clearly seen in the initial flight aptitude test scores (grey dots), where many points are relatively far from the regression approach line. This shows the differences in flying talent that are very varied in the cadets.

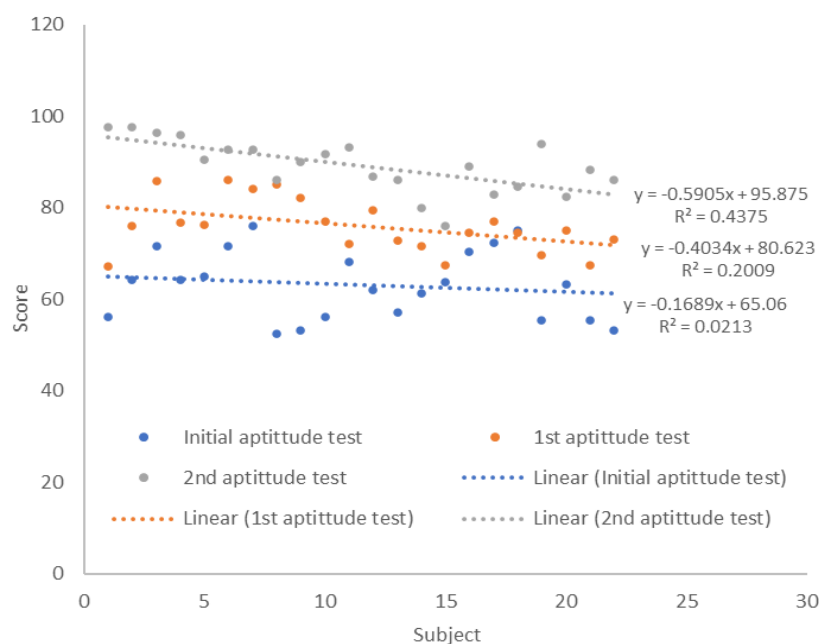


Figure 4. Aptitude test comparison

Figure 4 shows the scores for the initial flight aptitude test, flight aptitude test 1 and 2. The regression line approach shows significant differences in the three test results. The flight aptitude test 2 has a relatively greater value than the flight aptitude test 1 and subsequently the flight aptitude test 1 is greater than the initial flight aptitude test. This shows an increase in the cadets' test results as a process from the initial registration stage to stage 1 and 2 tests. The score increasing as an outcome shows that education and training in the aviation academy can increase cadets capability. These increasing represented by three step of processes. The academic atmosphere in Banyuwangi Indonesian Pilot Academy has promote responsibility for higher education professionals to consider ways to encourage students' with ethnical diversity for awareness and acceptance of difference (Trolan & Parker, 2022).

By referring to the passing grade of 60, it can be seen that in the initial flying aptitude test, some 7 cadets did not meet the passing grade. These seven cadets consist of 1 cadet from group I, 3 cadets from group II and 3 cadets from group III. At the flight aptitude test stages 1 and 2, these cadets can meet the passing grade criteria. This shows that the education and training provided can improve the performance of the cadets. Many failures happen to cadets from group II and group III which have lower education background. This is probably due to the lack of adaptation of these cadets. The role of faculty in promoting positive diversity attitudes among students requires additional research, however, the authors argue that faculty should have a distinct role in fostering positive and constructive diversity attitudes inside and outside of the classroom (Trolan & Parker, 2022). The rationales behind universities' embrace of diversity have nonlegal consequences that should be considered in institutional decision making (Starck et al., 2021).

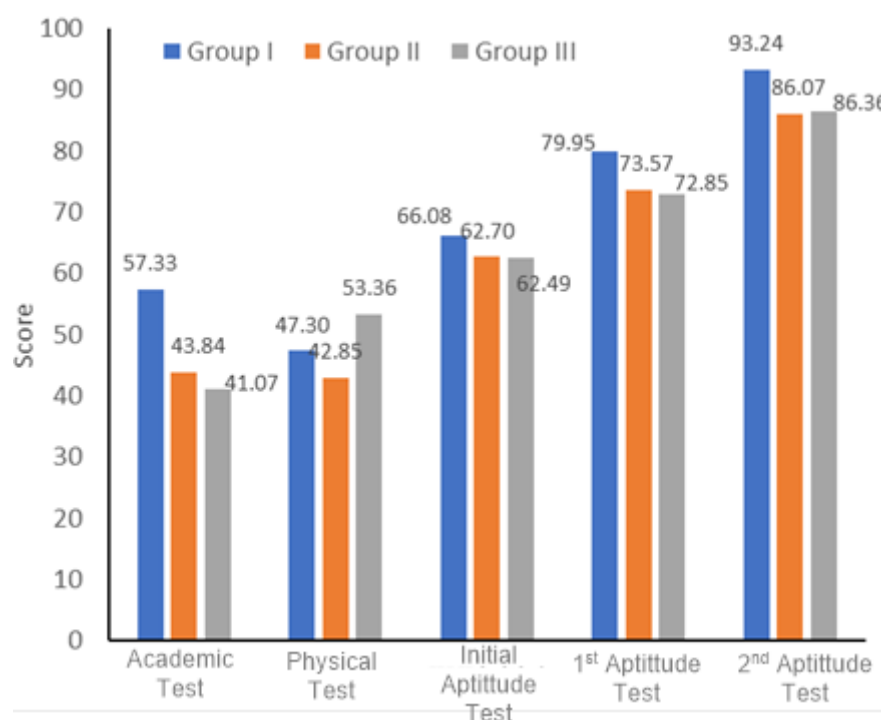


Figure 5. Test score based on subject group

Figure 5 shows that the test scores of group I tend to be higher than the scores of groups II and III. Group II and group III had results that were not much different. This indicates the difference caused by the area of cadets origin related to the previous level of education. The test scores from the initial aptitude test, 1st aptitude test and 2nd aptitude test stages did show an increase. This increase is an indication that the education and training process at APIB can improve the ability of the cadets. But the difference in the area of origin in general still leaves a gap. The demographic differences are reported can cause attrition in aviation education (Schulker et al., 2018).

Group differences in this study are differences in the area of origin where geographically, Indonesia has an ethnical difference that is included as culturally different. Different island mean different cultural people. Cultural diversity is one type of diversity that stands out in the field of education. In addition, education and training in a new place far from the area of origin is part of diversity in relation to migration (Messiou et al., 2022).

The gaps that occur also can be caused by the level of progress of the education system in different groups of regions of origin. It can be said that the education and training curriculum at the institution has succeeded in improving the performance of the cadets but still has not been able to resolve the differences caused by the region of origin. The existing curriculum has not been optimal as a whole to improve the performance of the cadets. Differences in the education development in different regions will generally lead to differences in teaching patterns, one of which is how a teacher teaches his students. Teacher performance influences student achievement. A research shows that of the teachers, 60% recognized diversity among students, but mainly based on students' shortcomings and perceived problems. Teachers seemingly translate their understanding of diversity into their didactic and pedagogical approaches only when these conditions are met (van Middelkoop et al., 2017).

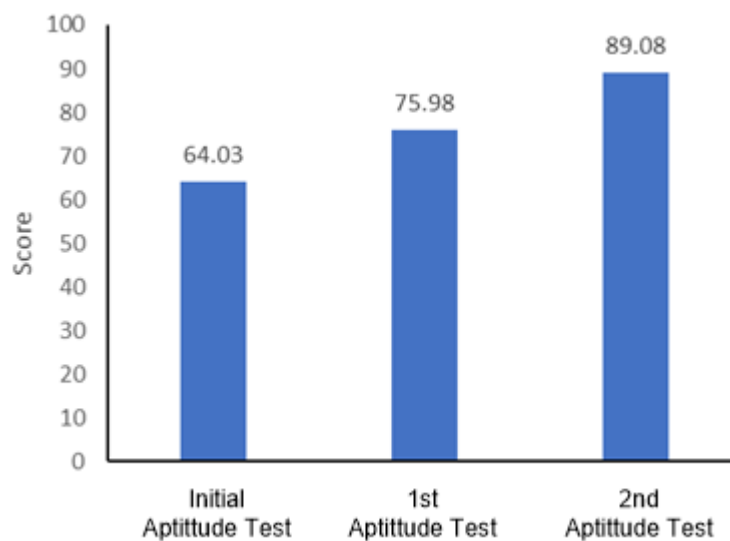


Figure 6. Average score of aptitude test.

Based on the average score of the flight aptitude test, there was a relatively significant increase from the initial flight aptitude test, flight aptitude test 1 and flight aptitude test 2. This increase is an indication that the education and training curriculum implemented has succeeded in providing appropriate educational products. If calculated by referring to the initial average score, there was an increase of 18.68% from the initial flight aptitude test to the flying aptitude test 1 and by 17.24% from the flying aptitude test 1 to the flying aptitude test 2. The fidelity of the curriculum used in the academy is part of adaptive learning where the cadets can adapt to the learning method being implemented. This is in accordance with the statement that adaptive learning is adapted to context analysis, learning load analysis, academic unit analysis, and curriculum analysis (Ramdani et al., 2022). The racial differences in the cadets study give recommendations a highlight potential untapped resource for solving the labor shortage facing the entire aviation industry (Stevenson et al., 2020).

The results of the analysis generally show an increase in the learning outcomes of the cadets. This increase is indicated by the test scores at the beginning of the registration process and the test results while carrying out the education and training process. Differences occur in the group of cadets with regional origins who have relatively more advanced educational processes where test scores are relatively higher than other groups. The results of the analysis can be used as the basis for developing the pilot's

education curriculum. The academy must always monitor the progress of the cadets from year to year to prevent non-optimal educational outcomes caused by diversity factors. It is currently commonplace for institutions of higher education to proclaim to embrace diversity and inclusion (Starck et al., 2021). Diversity and inclusion policies are necessary to create a more equitable aviation industry (Morrison, 2019).

CONCLUSIONS

The results of data analyses show that the curriculum at Indonesian Aviation Academy Banyuwangi can provide appropriate education and training for prospective pilot cadets. But on the other hand, there are still gaps in the test scores that show differences because of the cadets' origins. Cadets from areas with better education systems tend to have better test results. This research still has weaknesses in terms of the gap in educational progress that occurs between groups of regions of origin. On the other hand, the role of the flight instructor in the assessment of the test is an aspect of subjectivity. In future, more in-depth research is needed to strengthen the results of this research, including a more detailed background of the area of origin and parts of the curriculum that are still not optimal.

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