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Rate and Proportion Analysis of The Decision Model from Online Learning Sustainability

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Abstract

The human development index is built by three fundamental dimensions: long life and healthy life, knowledge, and a decent standard of living. This research was inspired by sustainable development goal number four, Quality Education. Quality of education has an excellent relation with knowledge management. This research collaborates nine parameters from fuzzy logic-based decision support model of online course learning research, participation rate, and the proportion of youth and adult involvement in formal and non-formal education. The result shows that from the participation rate, it concluded that those with stable expansion also consistently enrich their knowledge by attending formal or non-formal learning; female constantly learn more than male; people who lived in city has more urge to learn than people who live in villages. From the proportion in 2017, 2018 and 2022, people with information and computer technology skills increased significantly, showing good value. Nevertheless, while female participation in learning is higher than male, it does not mean female has better skills than male. This research uses statistical and spatial analysis and collaborates with previous research using Fuzzy logic-based decision support model as the sustainability of education growth. The novelty is using statistical analysis related to the soft computing method in decision-making to prove that participation rate and proportion rate matter as the spatial index of education growth for the human development index in Indonesia.

Keywords: Education participation rate, proportion rate, sustainable learning

1. Introduction

Poverty is one of the problems that concern the government in any country. (Sumarah & Tiara Wulandari, 2023). Poverty is a picture of life in many developing countries, including Indonesia. Based on data on Youth unemployment rates between 2019 and 2020, Indonesia's rate for this context was 16.3 in Q1 2020, making Indonesia in 19th rank from 44 countries in Asia.

The National Medium Development Plan directs Indonesia's economic development through 3 strategies: pro-growth, pro-job, and pro-poor. From this, Indonesia also moved to an increasingly advanced Indonesia. In terms of growth, there is education and economics.

Inequality of opportunity in education and health, in turn, will cause obstacles in entering the job market, affecting income levels. Policies should not solely focus on increasing per capita income to escape the middle-income trap. Curbing the rate of increase in income inequality and improving equality of opportunity is a priority. (Wibowo, 2017)

Socioeconomic factors impact all facets of human functioning, including health-related quality of life (Hawkins et al., 2020). The total population of Indonesia is 237,641,326 people, with a composition of 119,630,913 men and 118,010,413 women. From the composition of the population according to gender, it can be known the size of the gender ratio, which is the ratio of the number of male residents to the number of female residents. In 2010, the gender ratio of the Indonesian population was 101.4 percent. This means that there are 102 males per 100 females. Urban and rural areas have almost the same gender ratio (Statistik, 2010).

That data increases significantly; the mid-year population of 2020 was 270,203,900; in

2021, it was 272,682,500; in 2022, it was 275,773,800. (Zendrato & Cheng, 2023) Ever researched learning management, concluding that students were motivated to learn with pre and post-test activity.

In terms of education, this research discusses existing data from Badan Pusat Statistics of Indonesia and direct surveys about people's interest in non-formal learning. The background of non-formal education is to learn, get new experience, get a promotion, and fill empty time and obligations from work (training).

The concept of "Internet + Education" accelerated the construction and popularization of many online teaching platforms, accompanied by the emergence of massive open online courses and online classroom teaching platforms (Huang, 2023).

Equitable learning occurs when every learner belongs, contributes, and thrives, regardless of race/ethnicity or socioeconomic status. "Equity does not mean that all students obtain equal education outcomes, but rather that differences in students' outcomes are unrelated to their background or to economic and social circumstances over which students have no control" (Tate & Warschauer, 2022).

This paper discusses the sustainability from the parameter concluded using the fuzzy method on my previous research. Talking about sustainability, found another problem: youth and adult involvement in formal and non formal education impact knowledge quality and living standards. The method used in this paper is related to the statistical method and decision support system.

This research use technique can be applied in many applications, but it also has prerequisites and limitations that must always be considered in interpreting the findings (Schneider et al., 2010). JASP (Goss-Sampson, 2022) stands for Jeffrey's Amazing Statistics Program in recognition of the pioneer of Bayesian inference Sir Harold Jeffreys. This free multi-platform, open-source statistics package was developed and continually updated by researchers at the University of Amsterdam. This research uses this application to gain new novelty information on online learning's sustainability.

The novelty of this research is using statistical analysis related to the soft computing method in decision-making to prove that participation rate and proportion rate matter as the spatial index of education growth for the human development index in Indonesia.

2. Research Method

The data survey and data provided by Badan Pusat Statistic was the primary source for this research. The data are participation rate based on expenditure (Badan Pusat Statistik, n.d.-f), Proportion rate based on expenditure (Badan Pusat Statistik, n.d.-c), Participation rate based on gender (Badan Pusat Statistik, n.d.-e), Proportion rate based on gender (Badan Pusat Statistik, n.d.-b), Participation rate based on resident (Badan Pusat Statistik, n.d.-d), and Proportion rate based on resident (Badan Pusat Statistik, n.d.-a).

Participant rate is a crucial component of population-based reach. (Rackoff et al., 2023). The participation can be used to predict future angling participation (van der Hammen & Chen, 2020).

Parameters is important in proportion. (Bell et al., 2023). A time series model also can be created from proportion (Lobo et al., 2023). Based on proportion, the first quintile means 20 percent of the poorest resident. The second quintile means 20 percent of the poorest and the most vulnerable resident. The third quintile means 20 percent of residents with moderate expansion. The fourth quintile means residents with expenditure from middle to upper. Moreover, the fifth quintile means the wealthiest resident.

Expand means the expenditure in question is per capita on food, not food. Food includes all types of finished foods, beverages, tobacco and betel. Non-food includes housing, clothing, health costs, school and so on. Another vocabulary related to expenditure is Average Expenditure Per Capita a Month, which means the cost incurred for the consumption of all household members during the month divided by the number of household members.

Data surveys were obtained from (Sihotang & Utama, 2022). Based on (Vaus, 2002), a survey is not just a particular technique of collecting information. The experimental method is similar to the survey method in that data are collected in the variable-by-case grid form. However, it is fundamentally different in that the variation between the attributes of people is created by intervention from an experimenter wanting to see if the intervention creates a difference.

The method uses statistical analysis and spatial analysis and collaborates with the previous research using the Fuzzy Logic based decision support model as the sustainability of education growth. Here, the context is the sustainability of online education in the future. Research from (Mashroofa et al., 2023) talks about e-learning adoption for sustainable higher education. Electronic Learning (E-L) has played an essential role in the Higher Education (HE) sector, expanding opportunities, and producing employable, skilled and qualified graduates in

local and global job markets. This shows that sustainable learning matters for the future.

3. Results and Discussion

The survey data was given to 117 respondents with an age gap.

Table 1. Age range total respondents

Total respondents	Age range
11	10-20
84	21-30
13	31-40
7	41-50
2	> 50

From that data, 94 people ever took online courses, while 23 never took online courses. 33% use online learning platforms to get a job. 67% use online courses to learn, get new experiences, get promoted, and fill empty time and obligations from work (training).

Related to expenditure, the price of the course also influences. Many are interested if the course is free, even if paid it is a facility they get. From Table 1, it can also be seen that many course users are in the age range of 21-30.

Research by (Sihotang & Utama, 2022) ever studied online course materials using fuzzy Logic for finding decision support models. The result is 14 parameters grouped into Company Profit and User Benefit. The company profit parameter consists of business profits (income), net promoter score, number of website visitors, number of course users, and course user attendance.

Table 2. Parameter for Decision Model of Online Course

Parameter	Grouping Area
P1	Business Revenue
P2	Net Promoter Score
P3	Website Visitors
P4	Course User
P5	Attendance
P6	Access to material
P7	Ability to understand
P8	Personal Mentor
P9	Type of learning
P10	Material Preference
P11	Course Fee
P12	Get Certificate
P13	Experience
P14	Getting Job

User benefit parameter consists of access to materials the ability to understand the material; facilities received by users are divided into two, namely personal mentors and types of learning; material preferences; online course fees; and user objectives, which are divided into three, namely obtaining certificates, increasing experience, and job acquisition. Based on each parameter, it has its' own value and uses fuzzification and defuzzification.

The final decision is whether the material is published or not published, and based on the data, if the fuzzy area followed the rules, the company that considered the material should choose what the conclusion gets. The conclusion was verified considering the company's profit and user benefit. So, the final decision is helpful for the user searching for an online course and also beneficial for the decision unit of an online course company in determining an online material course.

(Ng et al., 2018) proved the effectiveness of the model utility test in testing the significance of a simple model with the significance level α=0.01, 0.025 and 0.05. This means this research also has a significance level but didn't compare to another evaluation because it is limited to analysis.

(De Mauro et al., 2018) Business leaders and HR managers establish clear strategies for acquiring and developing the right skills needed to leverage Big Data at best. The emergence of novel approaches across these components has brought considerable challenges for human resources management within existing companies. The advent of new data sources coupled with the renewal of methods and technologies used for business-impacting analytics require the development of new interdisciplinary competencies spanning from IT skills to business domain knowledge and communication skills.

This research discusses the participation rate and proportion of youth and adults learning information technology.

3.1. Participation rate by expansion.

Tables 3 and 4 show the Levels of adolescent and adult participation in formal and non-formal education and training in the past 12 months by expenditure group.

Table 3. 15-24 Years Old Expenditure Grouped.

Groups by expenditure	2018	2021
Lowest	40.78	38.90
Lower to middle	44.53	42.68
Middle	47.44	45.48
Middle to upper	50.00	48.82
Upper	59.41	58.79

Table 4. 25-64 Years Old Expenditure Grouped.

Groups by expenditure	2018	2021
Lowest	40.78	38.90
Lower to middle	44.53	42.68
Middle	47.44	45.48

Groups by expenditure	2018	2021
Middle to upper	50.00	48.82
Upper	59.41	58.79

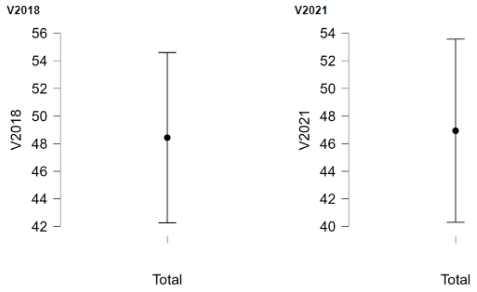

Figure 1. Interval Plots of expenditure 15-24 years old

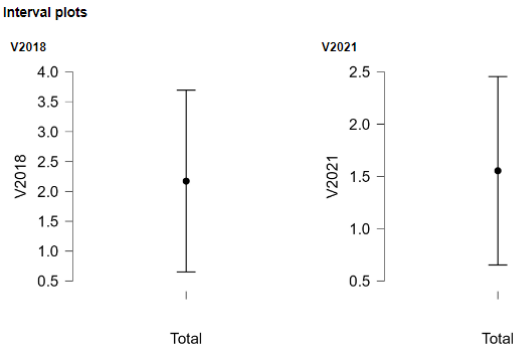

Figure 2. Interval Plots of expenditure 25-64 years old

Table 3 and Table 4 show a decline from 2018 to 2021 in the participation rate, but it is mostly filled by upper expansion. This means those with a stable expansion can consistently enrich their knowledge by attending formal or non-formal learning. Figures 1 and 2 show that the interval plot has a good median from the visual plot.

3.2. Participation rate by gender

Women have an essential contribution to economic growth and development. However, according to data, the Gender Inequality Index (GII) is still relatively high in developing countries, so special attention should be paid to aspects of women's empowerment, health, and participation in the labour market as an indicator in measuring GII (Al Faizah et al., 2022)

Most empirical studies have shown that women's education is an influential variable determining female labour participation. In addition to women's education, it turns out that the level of women's literacy also influences the level of women's labour force participation.

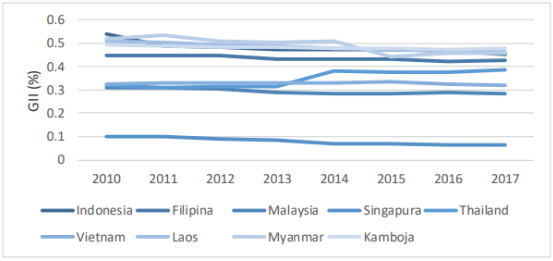

Figure 3. The trend of GII in ASEAN countries from 2010-2017 (Al Faizah et al., 2022)

Tables 5 and 6 show youth and adult participation rates in formal and non-formal education and training in the past 12 months by gender.

Table 5. 15-24 Years Old Gender Grouped.

Groups by Gender	2018	2021
Male	48.61	45.97
Female	48.71	48.49

Table 6. 25-64 Years Old Gender Grouped.

Groups by Gender	2018	2021
Male	2.34	1.61
Female	2.25	1.64

Table 5 and Table 6 shows that female during their 15-24 years old constantly participate in learning, but female during their 25-64 is not as constant as their 15-24 years old. In comparison, the male both from the age range 15-24 and 25-64 years old are decreasing. This means that female constantly takes learning than males.

3.3. Participation rate by resident

A unique opportunity for investigation lies with the Distressed Communities Index (DCI). The Economic Innovation Group developed this metric, a comprehensive estimate of socio-economic status by geographic location (Hawkins et al., 2020).

The DCI is a composite socioeconomic ranking that accounts for unemployment, education level, poverty rate, median income, business growth, and housing vacancies. Previous studies have correlated a higher DCI score (lower socioeconomic status) with worse health-related outcomes.

Tables 7 and 8 show youth and adult participation rates in formal and non-formal education and training by the County of Residence in the past 12 months.

Table 7. 15-24 Years County of Residence Grouped.

Groups by Residence	2018	2021
City	50.90	50.72
Village	45.72	42.08

Table 8. 25-64 years old gender grouped.

Groups by Residence	2018	2021
City	2.78	1.82
Village	1.67	1.36

Table 7 and Table 8 show that people who lived in the city had more urge to learn than those who lived in villages.

3.4. Proportion rate

Table 9 shows the proportion of adolescents and adults aged 15-59 years with Information and Computer Technology (ICT) skills by expenditure group (percent)

Table 9. The proportion of adolescents and adults aged 15-59 years by expenditure group

Grouped by Expenditure	2017	2018	2022
Quintile 1	18.10	26.73	60.43
Quintile 2	26.68	36.41	68.68
Quintile 3	34.53	45.82	73.70
Quintile 4	44.52	55.74	79.70
Quintile 5	68.43	77.25	88.58

Table 9 concluded that from 2017, 2018 and 2022, people with ICT skills increased significantly and shows good value.

3.5. Proportion rate

Table 10 shows the proportion of adolescents and adults aged 15-59 years with information and computer technology (ICT) skills by gender (percent).

Table 10. The proportion of adolescents and adults aged 15-59 years by gender

Grouped by Gender	2017	2018	2022
Male	67.88	73.51	78.41
Female	60.60	66.79	71.84

Table 10 concluded that while female participation in learning is higher than male, it does not make female has better skills than male.

3.6. Proportion rate

Table 11 shows the proportion of adolescents and adults aged 15-59 years with Information and Computer Technology (ICT) skills by area of residence (percent)

Table 11. The proportion of adolescents and adults aged 15-59 years by area of residence

Grouped by Resident	2017	2018	2022
City	75.17	79.78	82.76
Village	49.77	56.98	64.70

Table 11 concluded that people who stayed in the village still didn't meet the number of people who stayed in the city with ICT skills. This means that needed innovation to gain interest in studying for village residents.

Data from a, b, and c are pointed to the participation rate and focused on the involvement of adolescents and adults in learning from formal and non-formal learning. Data from d, e, and f are pointed to the proportion rate and focused on adolescents and adults with technology skills.

Concluded from the survey, participants who took the online course were affected by age and course price, so this research tried to discuss the participation rate and proportion rate based on three groups, they are: by expansion, by gender, and by resident area.

Combining the result from the previous study in an online course using a fuzzy logic-based decision support model, parameter number eleven, course fee is related to how people use their expansion to enrich their knowledge by joining formal or non-formal learning.

From the participation rate, it was concluded that those with stable expansion also consistently enrich their knowledge by attending formal or non formal learning; female is constantly taking learning than male; people who lived in city has more urge to learn than people who live in villages.

The solution for this case is to increase the number from every expansion group, gender group, and residence area group for taking more knowledge to gain more quality of education. Making an affordable price, discounted prices, more related topics, and charming learning way are other solutions for increasing the number of participations of the learners.

From the proportion, from 2017, 2018 and 2022, people with ICT skills increased significantly, showing good value. Nevertheless, while female participation in learning is higher than male, it does not mean female has better skills than male. Last, an innovation to gain interest in study from village residents.

4. Conclusion

This research collaborates nine parameters from the Fuzzy logic-based decision support model experiment, participation rate, and the proportion of youth and adult

involvement in formal and non-formal education. Indonesia, a 275,773,800 population, still struggles to exit from the Middle-Income Trap Country. One solution to do is to increase the education quality. Combining the result from the previous study in an online course using a fuzzy logic-based decision support model, parameter number eleven, course fee is related to how people use their expansion to enrich their knowledge by joining formal or non-formal learning.

From the participation rate, it was concluded that those with stable expansion also consistently enriched their knowledge by attending formal or non-formal learning; females constantly learn more than males; people who live in cities have more urge to learn than people who live in villages. From the proportion from 2017, 2018 and 2022, people with ICT skills increased significantly, showing good value. Nevertheless, while female participation in learning is higher than male, it does not make female has better skills than male. Last, we needed innovation to gain interest in study to village residents.

The solution for this case is to increase the number from every expansion group, gender group, and residence area group to gain more knowledge to gain more quality education. Making an affordable price, discounted prices, more related topics, and charming learning ways are other solutions for increasing the number of participants of the learners.

The use of statistical analysis related to the soft computing method in decision-making has gain new proof that participation rate and proportion rate matter as the spatial index of education growth for the human development index in Indonesia as a novelty for the education research section.

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