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Martya Makful

Faculty of Public Health, Universitas Indonesia, martya_makful@yahoo.com

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The effectiveness of Geographic Information System training for surveillance officers in the Sukabumi district

Martya Makful^{a*}

^a*Faculty of Public Health, Universitas Indonesia*

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Abstract

Surveillance is the systematic, continuous collection, processing, analysis and interpretation of data and its dissemination to entities that can act on it. An organization's human resources (HR) department has a very important role in the field of health care because the quality of public health services is determined by the effectiveness of the human resources working on them. With the Sukabumi district's large number of outbreaks and reports, it is necessary to have an effective system for gathering information and recording data. The purpose of this research is to understand the effectiveness of Geographic Information System (GIS) training for health surveillance officers in the Sukabumi district by analyzing the results of training competence measurements. This study used a mixed research method consisting of interview techniques and statistical analysis (MANOVA). The research results reveal that there is a correlation between the training participants' knowledge and their education level. Data analysis training using GIS-based health data can increase the competence of surveillance officers and health center managers in performing data processing in GIS applications. This research can be referenced in conducting community training, especially for health surveillance officers. Also, among the relationships between age, education, and gender, only educational level is related to knowledge level. This application of science and technology is not only important for health service officers in the Sukabumi Regency, but also in the Sukabumi District Health Office, because prevention programs for communicable diseases must be coordinated across sectors.

Keywords: effectiveness, competences, surveillance, GIS, community

1. Introduction

Surveillance is used to monitor disease events and trends, detect and predict outbreaks in the population, and observe factors affecting disease events such as biological changes in agents, vectors, and reservoirs. Furthermore, surveillance allows information to be linked to and aligned with decision makers in order to create effective preventive disease control measures.

The role of the public health surveillance officer is tasked with providing early vigilance information for decision makers and managers about health issues that need to be addressed within a given population. Public health surveillance is an important instrument

*Correspondence Author: martya_makful@yahoo.com

for preventing disease outbreaks and developing an immediate response when disease begins to spread (Mahfudhoh, 2015).

Training represents an organization's planned effort to facilitate learning work behavior. Training is an employee learning process that involves acquiring skills, concepts, rules, and/or attitudes to improve performance. On-the-job training describes the entire activity of obtaining, improving, and developing work competence, productivity, discipline, attitude, and work ethic at certain skill levels according to the occupation and position qualifications. Training can also be briefly defined as an activity done to improve the current and future performance. Training describes the process of systematically changing employee behavior to carry out a current job. Training is oriented to current performance and helps employees achieve certain skills and abilities to succeed in their work. The purpose of this research is to analyze the effectiveness of GIS training for surveillance officers in Sukabumi Regency based on the aspects of reaction to learning and behavior.

One cause of decline in employee performance is due to the discrepancy between employee capability and an increasingly competitive workplace. Many argue that among the factors affecting the decline in employee ability is a lack of attention by the agency or organization to provide appropriate education and training programs. Competency enhancement at work is a new routine task where employee needs now include the ability to adapt to new work processes, including new technologies and tools. Hence the need for them to have training. However, work-related training is not limited to institutional development programs. Development potential also arises when employees have the opportunity to engage in work-related activities and interactions that allow discretion (Billett, 2014).

The purpose of this study is to review the overall effectiveness of GIS training for improving decision-making, applying newly acquired knowledge and skills, and finding greater motivation to change and improve employee attitudes and behaviors. From the assessment's results, we see that training is expected to create career progress, increased income, and increased job satisfaction for surveillance officers. The training and development objectives are as follows: (a) increase the quantity of output; (b) improve output quality; (c) reduce waste and maintenance costs; (d) reduce the number and cost of

accidents; (e) reduce turnover and absenteeism while increasing job satisfaction; (f) prevent the occurrence of employee antipathy (Rivai, 2005). The problem addressed by this research is how much trainee competence improves after they receive training, measured according to knowledge, skill, self-concept, and motivation.

GIS mapping technologies have the potential to advance public health promotion by mapping regional differences in attributes (e.g., disease burden, environmental exposures, and access to health care services) so that the appropriate priorities for public health interventions can be suggested (Hopfer *et al.*, 2009).

GIS technology supports a company's spatial problem and staff planning activities. This aligns with efforts to improve the ease, reliability, accuracy, and timeliness of operational activities into important issues that encourage the need for information technology. With the application of GIS-based technology, information generated from health data analysis training by surveillance officers can provide material intervention based on a specific local area. This will allow the Health Office and related stakeholders to have baseline data related to vulnerable areas of intervention focus, including mother and child health and HIV/AIDS, for example.

Implementation of surveillance programs in the Sukabumi district includes response activities, early awareness of outbreaks, and implementation of the Early Warning Alert System. Surveillance activities are carried out through tracking and field investigations in addition to increasing early awareness about the diseases that tend to cause outbreaks. Puskesmas Surveillance Officers deliver complete and accurate weekly reports that appraise staff performance as the first step in anticipating an outbreak.

With the number of reported cases of outbreaks in the Sukabumi district, it is necessary to maintain a system to record information and data. The surveillance of infectious diseases by the Sukabumi District Health Office has not resulted in any regional-based information in the surveillance records. There are still data redundancies because both the District Health Office and the KPA Sukabumi district have not been able to update the maps produced due to the limited knowledge about GIS.

GIS and Global Positioning Systems (GPS) equipment are very supportive in agency or company work with spatial problems, as well as with planning expert staff. This is because

the efforts to improve reliability, accuracy, and timeliness in operational activities have become important issues that encourage the need for information technology.

2. Methods

This study's design used a quasi-experimental and training intervention method with an evaluation research approach, with the goal of receiving feedback that will be used as the basis to improve a program (Notoatmodjo, 2010). This research method uses a Participatory Rural Appraisal (PRA), which is effective with a small number of samples. Narayanasamy (2009) states that PRA works based on a combination of people's knowledge and opinions in planning and developing a program. The training participants numbered 40 people gathered from the data and information management staff at the health department, community health center, Sukabumi service office, NGOs private community institutions, and the National Narcotics Agency.

Data collection was conducted by interviewing participants using GIS training in the Sukabumi district. The equipment consisted of a questionnaire given to the respondents. The research questionnaire contained a list of statements relating to the participant's perceptions of training effectiveness and increased competence of participants after training. The questionnaire answers were determined using a Likert scale (values 1 - 5).

The first step of data processing was to conduct a validity test to determine the reliability of the questionnaire. The validity test is used to indicate the extent to which a questionnaire device measures results accurately, while the reliability test is used to determine the level of reliability of the data generated by an instrument; when these tools are used in the same group at different times, it shows the stability of the measurement results.

This research method used a mixed-method analysis. Mixed-method research combines qualitative and quantitative research approaches. Multivariate analysis was done using a MANOVA to get a model of training effectiveness based on gender, age, and education level. The output of this analysis shows the difference between groups and outputs that test each variable individually. MANOVA analysis is a statistical method of exploring the relationship between independent variables such as age, education level, and gender with a dependent

variable; in this case, the competence of training (knowledge, skill, self-concept, and motivation).

Descriptive analysis was used to understand the employees' perception in assessing each analyzed item or variable. This step of analysis began by determining the minimum scores obtained from the research data for each criterion, then calculating the range of scales for each of these criteria, then drawn conclusions. Calculations for the scale range according to Umar (2005) can be seen in Table 1.

Table 1. The average scale scores

Scale	Answer	Interpretation Results
1.00–1.80	strongly disagree	Not very effective
1.81–2.60	Disagree	Not effective
2.61–3.40	Neutral	Less effective
3.41–4.20	Agree	Effective
4.21–5.00	strongly disagree	Very effective

Source: Umar (2005)

3. Result and Discussion

There were no administrative or bureaucratic obstacles during the training. The AIDS Response Commission and related stakeholders in the Sukabumi district were very enthusiastic and welcomed the event. The number of participants was limited to 40; these individuals hoped to participate in advanced GIS training so that they could deepen their scholarship, especially in spatial analysis. Training also plays an important role in performance management. Public health surveillance is used to determine the community's health status, monitor the development of public health, determine health priorities, evaluate health programs, and develop research health (Mahfudhoh, 2015).

Several types of training skills can be found within an organization; these are often found by looking at an assessment. An effectiveness assessment of the training is based on the objectives identified at the assessment stage. Retraining provides employees with the skills

needed to meet changing work demands through cross-functional training. This involves employees training to conduct work activities in fields other than their assigned areas. Training is an integrated process used to ensure that employees work to achieve organizational goals. Training is a learning process that involves acquiring skills, concepts, rules, or attitudes to improve employee performance (Wahyuni & Artanti, 2013).

For this training, there was no disruption to the availability of hardware, because it used an Android-based mobile phone and Quantum GIS, an open source mapping software. The accessibility by HR as a user had no obstacles; many participants joined in registering during the training. It is expected that future participants from other health institutions or programs will be able to participate in this training. Participants have begun implementing this Open Source GIS because it is easy to do in the field application. As many as 40 participants from 18 government and private agencies such as hospitals, AIDS care groups, community health centers and private institutions registered.

Measurement and evaluation of the effectiveness of a training program is based on information obtained about five levels of reactions, learning, behaviors, organizational results, and cost. On the second day, the training participants conducted field practice using GPS. GPS is a navigation system that was first developed by the United States Department of Defense in the early 1970s.

3.1. Description of training participants

Training is required in order to obtain quality human resources. Training is considered capable of producing a high-quality workforce through its modern mindset and way of acting. Effective economic resources require a high level of use of organizational and technical skills. That is, the results or outputs obtained are balanced by the available inputs (economic sources). Training activities are expected to improve surveillance officer competence (Clay-Williams & Braithwaite, 2009). The level of improvement in this competence has practical implications for human resource planning (Amahoru, Setyorini & Prabowo, 2013). Knowledge and skills competencies are relatively easy to develop, and training is the most effective way of ensuring employee skills improve in these areas. There are two characteristics of achieving competence in training: 1) Motive, which describes

anything related to someone's willingness or desire to consistently lead to action; 2) Self-Concept, which includes attitudes, values, and a person's self-image and self-confidence.

Competence is a combination of knowledge and skills that is relevant to the employee's job. Competence is the capacity to handle a job or task based on predefined standards. Without the right competence level, performance will not be optimal. However, more competence demands more skills than just knowledge (Kaligis *et al.* 2017).

In the end, there were 40 trainees. The average age of the trainees was 32 years (Std Dev 6.6 years). As many as 18 people were aged between 31-40 years. The gender of the trainees was mostly male, with 32 people (80%), and as many as 24 people (60%) graduated with bachelor's degrees.

Table 2. Description of Training Participants

Variables		Frequencies	
		N	%
Age (years)	20-30	17	42.5
	31-40	18	45
	≥41	5	12.5
Gender	Male	32	80
	Female	8	20
Education	High School	2	5
	Diploma	14	35
	Undergraduate	24	60

Source: Data collection

3.2. Training of GIS

The GIS training was expected to improve the competence of surveillance officers in the territory as controlled by using applications or information systems tools. The categories in these competencies refer to the information and learning outcomes that a person has in

certain areas. Skill is a person's ability to perform a job, both physical and mental. Competence is defined as the underlying characteristics of behavior that describe an individual's motives, personal characteristics, self-concept, values, knowledge, or expertise that a person with superior performance shows in the workplace. Competence is the basic character of a person who has an effective way of behaving or thinking that prevails in a wide range of situations and endures for a long time (Dewi, Ismail & Kusdhany, 2018).

The presence of GIS technology strongly supports an agency's or company's activities that are related to spatial problems and expert planning staff. This is in line with efforts to improve reliability, accuracy, and timeliness in operational activities; these important issues encourage the need for information technology. Applying GIS-based technology is expected to generate information from health data analysis training by surveillance officers that can provide intervention material based on specific local areas. Thus, the Health Office and related stakeholders can obtain data baselines for procurement, maternal and child health, HIV/AIDS, and other areas prone to intervention.

GIS is a system used to manage geographic information. GIS gathers geographical information that describes a state of space or region spatially. On the first day of training, participants are introduced to GIS through material providing the basic concepts of the system. Participants were also introduced to the open source mapping software called Quantum GIS.

On the second day of training, the participants conducted field practice using GPS. GPS is a navigation system that was first developed by the United States Department of Defense in the early 1970s. Training with GPS uses an Android-based system to determine locations on the surface of the earth with the help of synchronized satellite signals. Simple map making and gathering point data using GPS is indispensable for health surveillance officers (Choi & Jie, 2014). During the training, participants used GPS devices to perform data collection techniques with real time data by entering latitude and longitude points in places that are considered hotspot points; that is, the point of infectious disease. In addition to the hotspot points, participants also practiced entering point data from health services locations such as hospitals, health centers, clinics, and pharmacies (See Figure 1).

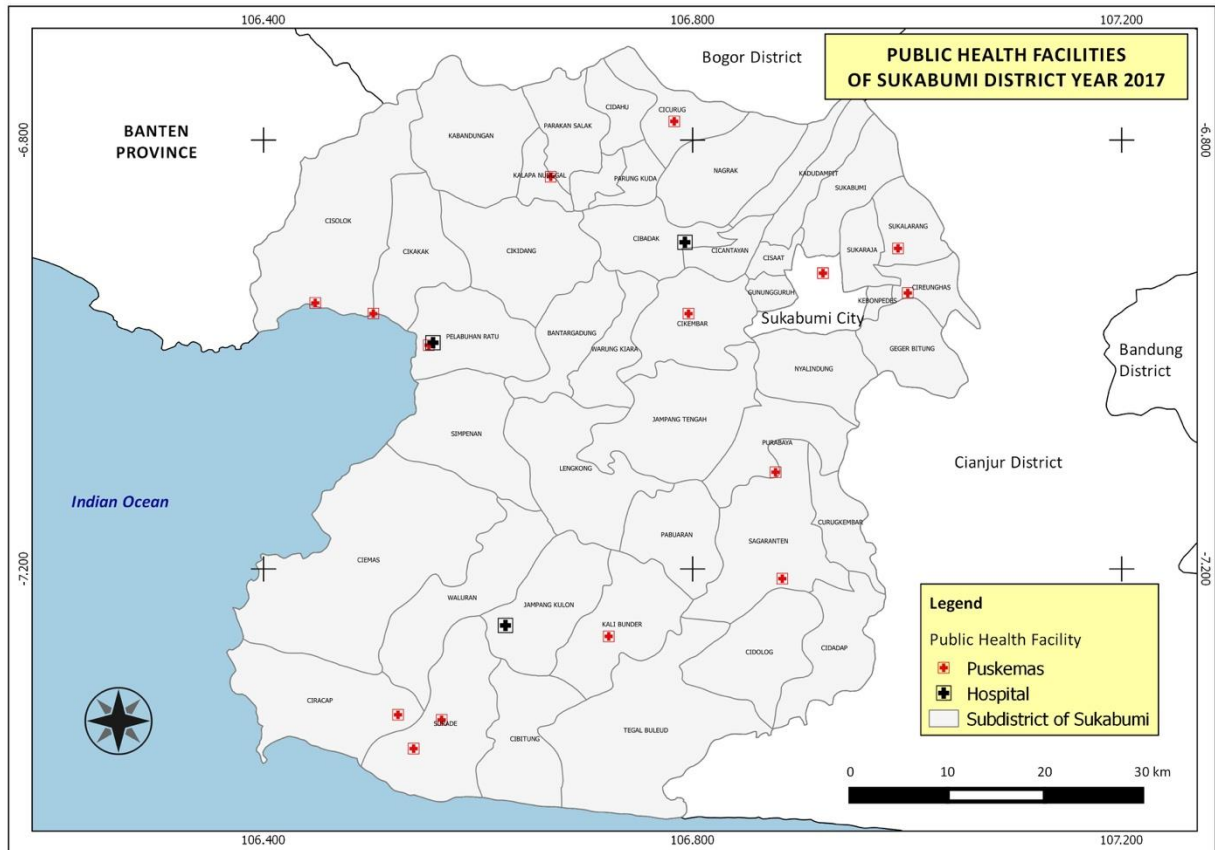


Fig. 1 Map of Public Health Facilities of Sukabumi District

Figure 1 shows the distribution of health services in Sukabumi district. Data collection in the form of point data is the result of training using each participant's GPS representing each health service sub-district in the Sukabumi district. The map of health services distribution has points with two different colors showing the health service types. Black indicates the hospital, while red indicates the community health center.

From the application of the plotted GPS mapping data, we can see the key unreached populations of HIV/AIDS testing facilities due to the limited HIV-AIDS services based on a lack of support (See Figure 2). Simple mapping is used as a reference in planning the HIV/AIDS service and outreach program in Sukabumi. The key population must be able to access programs that are run efficiently and effectively to reduce the HIV epidemic.

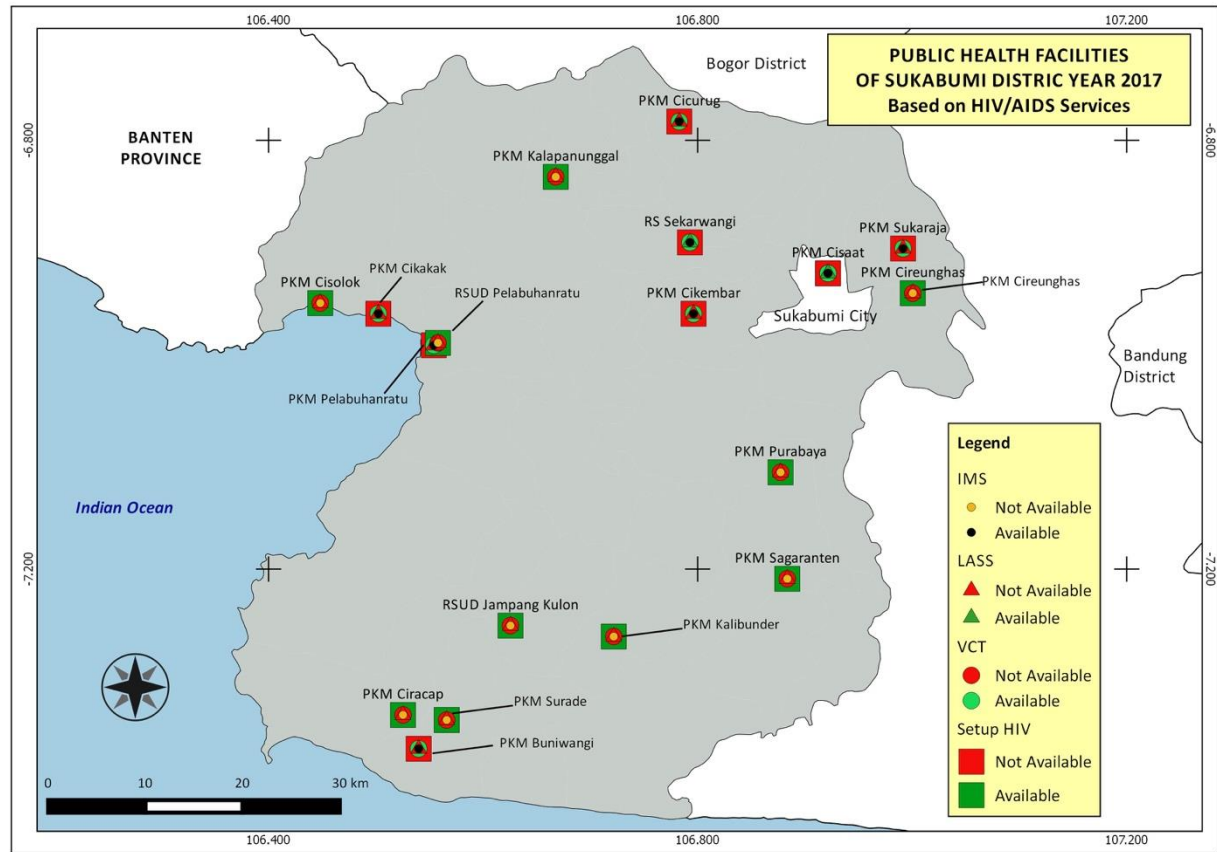


Fig. 2 Map of Public Health Facilities Based on HIV/AIDS Services

Disease mapping has been used as an effective public health tool for disease prevention, intervention development, health outcome evaluations, population risk assessments, scenario development, and regional health indicator summary and presentation. GIS is also a useful tool that supports decision-making, especially for health services program holders. Simple mapping applications can be used to create health indicator maps that health care providers, public health managers, and policy makers can easily use in practice (Nykiforuk & Flaman, 2011).

3.3. Descriptive education of the competency training

Table 3 shows the relationship between education level and each training competency. As seen in Table 3, the education level of GIS participants shows a difference in their level of competence in knowledge achievement after completing training, while the other

competencies do not show any difference among trainee education level. Generally, people who have higher education, whether formal or informal, will have broader insights, especially in appreciation of the importance of productivity. The higher awareness of the importance of productivity in turn encourages the relevant workforce to be more productive.

Table 3. Analysis of training competency on education level

Dependent Variable	df	df error	F	Education Level	Mean	Std. Error	95% Confidence Interval		Sig.
							Lower Bound	Upper Bound	
							Knowledge	2		70	3.44	High school	4	0.209	3.576	4.424
				Diploma	4	0.097	3.804	4.196	0.043
				Undergraduate	4.304	0.076	4.151	4.458	
Skill	2	68	0.029	High school	4	0.219	3.557	4.443	
				Diploma	4	0.101	3.795	4.205	0.972
				Undergraduate	4.029	0.079	3.869	4.189	
Self-Concept	2	66	1.009	High school	3.667	0.213	3.235	4.098	
				Diploma	4	0.099	3.8	4.2	0.374
				Undergraduate	3.942	0.077	3.786	4.098	
Motive	2	35	1.739	High school	4	0.219	3.556	4.444	
				Diploma	4.071	0.102	3.866	4.277	0.19
				Undergraduate	4.283	0.079	4.122	4.443	

Based on education level, the average value of answers to questions about the competence of training (especially on knowledge, skill, and motive) is between 4.00 and

4.20, which means that the competence acquired was between effective and very effective. Meanwhile, the self-concept competence assessment was between 3.61 and 4.00, which means that self-concept did not affect the trainees' ability to improve their self-concept.

Education level affects a person's ability and development. Basic education provides basic knowledge about life purposes and skills; then advanced education then continues from there. There is no difference among the effects of training according to education level. However, a low education level may not be associated with cognitive decline in training (Clark *et al.*, 2016).

Differences in education level of surveillance officers does not indicate any difference in the competence of this training; this means that a higher education level does not mean it is easier to understand the training material. This is because the GIS training is more about training using a person's mapping tool skills.

3.4. Descriptive gender and the training competencies

Table 4 shows the value and relationship between the trainees' gender by training competencies. For the data by gender, the average value of answers to questions about the competence of the training fell between 4.00 and 4.30, which means that the acquired effective competence was very effective. The skill competency assessment for female participants returned a value of 3.87, which indicates that women do not feel as effective in operating GPS devices when conducting field surveys.

Gender differences can affect a person's productivity level. Male productivity levels are universally higher than women. This is influenced by factors such as that women are physically less powerful, and that they tend to use feelings more in their work. Health surveillance work tends to be performed mostly by males because they are outdoors a great deal doing field surveys.

Table 4. Analysis of training competence on gender

Dependent Variable	df	df error	F	Gender	Mean	Std. Error	95% Confidence Interval		Sig.
							Lower Bound	Upper Bound	
Knowledge	1	35	0.553	Male	4.25	0.075	4.098	4.402	0.462
				Female	4.125	0.15	3.821	4.429	
Skill	1	35	1.469	Male	4.156	0.104	3.946	4.366	0.233
				Female	3.875	0.208	3.455	4.295	
Self-Concept	1	35	0.4	Male	4.125	0.088	3.946	4.304	0.531
				Female	4	0.177	3.642	4.358	
Motive	1	35	3.455	Male	4.313	0.075	4.16	4.465	0.071
				Female	4	0.15	3.696	4.304	

Based on the study results, the proportion of female surveillance officers did not make a significant difference. This is because in the field or at the time of the surveillance activities, the male surveillance officers had more advantages in situations when compared with female surveillance officers. The women were less task-oriented when they worked with male teams than they were working within the same gender group, but men were more task-oriented in mixed gender groups (Myaskovsky, Unikel & Dew, 2005; Harteis *et al.* 2015).

3.5. Descriptive age and the training competencies

Table 5 shows the value and relationship between trainee age group and training competencies. For the data by age, the average value of answers to questions about the competence of the training were between 4.00 and 4.30, meaning that the acquired effective competence was very effective. The age factor is directly related to work

productivity. Employees perceive age as being able to reduce or improve productivity. In this study, no significant relationship was found between age and work competence.

The lack of influence of age on training competence level may be since most trainees were over the age of 30 (57.5%). As a person ages, their maturity level and strength increases (Kubeck *et al.*, 1996; Dewi, Ismail & Kusdhany 2018). This study proves that there is no difference in competence level obtained based on age. These findings differ from research conducted in Nigeria of farmers carrying out daily work. The higher the maturity level, the stronger a person should be in thinking and working. Employee age also explains the level of work compliance. Based on public trust, someone who is more mature is more trusted because of their experience and maturity of their soul (Okeowo 2015; Fietzer, Mitchell & Ponterotto, 2018).

Table 5. Analysis of training competence by age

Dependent Variable	df	df error	F	Age	Mean	Std. Error	95% Confidence Interval		Sig.
							Lower Bound	Upper Bound	
Knowledge	2	70	0.081	20-30	4.25	0.108	4.031	4.469	0.922
				31-40	4.222	0.102	4.015	4.429	
				≥41	4.167	0.177	3.808	4.525	
Skill	2	68	0.224	20-30	4.063	0.151	3.757	4.368	0.801
				31-40	4.167	0.142	3.879	4.454	
				≥41	4	0.246	3.502	4.498	
Self-Concept	2	66	0.1	20-30	4.063	0.127	3.805	4.32	0.905
				31-40	4.111	0.12	3.868	4.354	
				≥41	4.167	0.207	3.746	4.587	
Motive	2	35	0.138	20-30	4.25	0.112	4.023	4.477	0.871
				31-40	4.278	0.106	4.064	4.492	
				≥41	4.167	0.183	3.796	4.538	

Age is enough to determine success in laboring at a job, both physical and nonphysical. In general, older workers are weaker and have more limited physical strength, whereas younger workers tend to have strong physical capabilities. Some meta-analysis studies suggest that a person's age is not related to their performance and competence level (Kubeck *et al.* 1996; Prasatin, 2013).

3.6. Analysis of the relationship between participant characteristics and training competence

Based on the MANOVA analysis results (See Table 6), it was found that the lowest knowledge competence occurred between the ages of 20 and 30 years for female high school graduates. The statistical relationship shows that education level has a significant relationship with knowledge competence. This case shows that age and gender did not indicate any form of training competence against rising knowledge levels.

Participants between 20 and 30 years old did not feel that their skills were improved by the training. From an education level, high school graduates received the lowest scores of competence results in relation to their training skills.

Table 6. Parameter Estimates for Competences

Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
knowledge	Intercept	4.293	0.251	17.137	0	3.784	4.802
	[Age = 1.00]	-0.039	0.214	-0.183	0.856	-0.474	0.396
	[Age = 2.00]	0.004	0.201	0.022	0.983	-0.404	0.413
	[Age = 3.00]	.	.	.	.	.	.
	[Education = 1]	-0.355	0.274	-1.296	0.204	-0.912	0.202
	[Education = 2]	-0.283	0.149	-1.903	0.066	-0.584	0.019

Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
	[Education = 3]	0 ^a	.	.	.	.	.
	[Gender = 1]	0.089	0.17	0.522	0.605	-0.256	0.434
	[Gender = 2]	0 ^a	.	.	.	.	.
	Intercept	3.74	0.365	10.244	0	2.998	4.482
	[Age = 1.00]	0.097	0.312	0.31	0.758	-0.537	0.731
	[Age = 2.00]	0.172	0.293	0.589	0.56	-0.422	0.767
	[Age = 3.00]	0 ^a	.	.	.	.	.
skill	[Education = 1]	-0.04	0.399	-0.1	0.921	-0.852	0.772
	[Education = 2]	0.071	0.216	0.329	0.744	-0.369	0.511
	[Education = 3]	0 ^a	.	.	.	.	.
	[Gender = 1]	0.277	0.247	1.119	0.271	-0.226	0.78
	[Gender = 2]	0 ^a	.	.	.	.	.
	Intercept	3.988	0.308	12.937	0	3.361	4.614
	[Age = 1.00]	-0.06	0.263	-0.227	0.822	-0.595	0.475
	[Age = 2.00]	-0.04	0.247	-0.16	0.874	-0.542	0.463
	[Age = 3.00]	0 ^a	.	.	.	.	.
Self-Concept	[Education = 1]	-0.044	0.337	-0.131	0.897	-0.729	0.641
	[Education = 2]	0.166	0.183	0.909	0.37	-0.205	0.537
	[Education = 3]	0 ^a	.	.	.	.	.
	[Gender = 1]	0.124	0.209	0.592	0.558	-0.301	0.548

Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
	[Gender = 2]	0 ^a	.	.	.	.	.
	Intercept	4.087	0.256	15.939	0	3.566	4.608
	[Age = 1.00]	0.003	0.219	0.013	0.989	-0.442	0.448
	[Age = 2.00]	0.071	0.206	0.345	0.732	-0.347	0.489
	[Age = 3.00]	0 ^a	.	.	.	.	.
	[Education = 1]	-0.321	0.281	-1.145	0.26	-0.891	0.249
Motive	[Education = 2]	-0.201	0.152	-1.32	0.196	-0.51	0.108
	[Education = 3]	0 ^a	.	.	.	.	.
	[Gender = 1]	0.28	0.174	1.61	0.117	-0.073	0.633
	[Gender = 2]	0 ^a	.	.	.	.	.

Self-concept is a training competency in individuals must be able to organize themselves in the field to carry out their work, especially as field surveillance personnel. The lowest self-concept for trainee participants was found in 30 to 40-year-old senior high school graduates. This may be caused by a feeling of inferiority among surveillance officers of that age who only graduated from high school.

GIS provides the tools to assist planning programs by analyzing spatial patterns. GIS integrates hardware and software designed to integrate, map, and analyze spatial data. It has been available since the 1990s. GIS can combine spatial data on different scales, from different parts of the world, and various time periods as long as the data contains information about location. Spatial information can take the form of very specific locations such as street addresses, longitude and latitude coordinates, political districts such as

wards, municipalities and districts, or administrative units such as census or postal codes (Hillier, 2010).

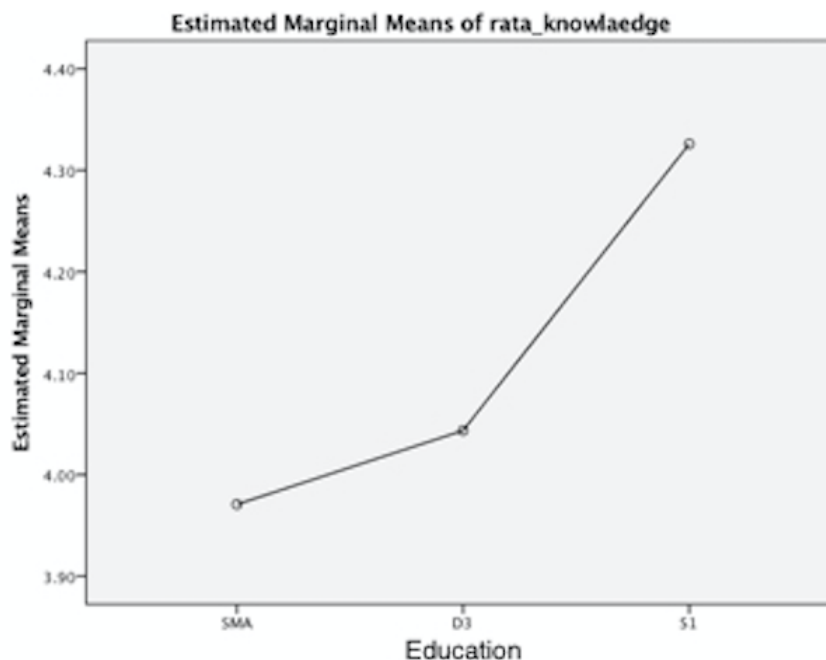


Fig. 3 The correlation between knowledge and education background

Participants' motivation to use technology-based work tools in the field, especially after they receive GIS training (use of GPS device) was also measured. The trainees' lowest motivation scores were in the 20 – 30-year age group and were high school graduates. The low motivation is most likely due to their low education levels, which cause the trainees to feel incompetent using the mapping technology application. Although there is no relationship between training and trainee competencies, the ability to use mapping is a well-received source of knowledge in the sense that many participants find it useful to look at the spatial perspective of governance issues, and therefore they welcome the repetition of knowledge resource mapping. However, due to lack of capacity and technical expertise, as well as the tendency of leadership to use administrative efficiencies to measure performance instead of effectiveness, there is little hope that GIS mapping will be included in strategic analyses (Pfeffer *et al.*, 2011; Teixeira, 2018).

Organizational effectiveness and employee performance need to be supported by high willingness (motivation) and work ability (competency) that align with the substance of

work required, a comfortable and conducive environment, income security that can meet minimum living needs, adequate social security, good working conditions, and a harmonious working relationship (Haas, Mincemoyer & Perkins, 2015; Davila *et al.*, 2015).

GIS is an innovative technology that can be used to bridge the interface between science and practice using spatial aspects to link health outcomes with individual behavior and ecological factors. GIS can be effectively used to monitor and assess specified program interventions while simultaneously tracking changes in public health. These applications must be carefully designed and evaluated to ensure validity, reliability, and transparency, and to increase accountability for evidence-based policies and practices. We believe that the communication and involvement of stakeholders in the development and display of knowledge (data) in the mapped format is very important for the absorption and usefulness of the product. Collaboration among disciplines and between methodologists and theorists from health and social sciences are needed to advance the development of GIS applications that are relevant to health and our conceptualization of complex ecological relationships between health and location. Applied research partnerships are based on the expertise of social scientists and practitioners from the health, environment, and community sectors; these are also important for evaluating future GIS applications. The GIS approach in public health practice and research offers us the opportunity to examine the role of the health context, especially in relation to creating a supportive environment (Nykiforuk & Flaman, 2011; Bertrand *et al.*, 2014).

Limitations in training evaluation must be considered. This study had small samples and self-reported data. Some participants did not submit all evaluation forms, perhaps because of lack of time or understanding. Training participants' feedback on the impact of training was limited to those who completed field assignments, while supervisory feedback was limited to those attending the presentation. It is possible that not enough time has passed to detect changes in trainee workplace behavior from the results of the training. The results of this study also cannot represent other community health workers in West Java, and these results cannot be generalized to other provinces or to other countries.

4. Conclusion

The effectiveness of GIS training for surveillance is based on the competencies of knowledge, skill, self-concept, and motive. Among the relationships between age, education, and gender, only knowledge and educational level are related. Evaluating the participants' reactions means measuring their satisfaction.

A training is considered effective if it is enjoyable and satisfying for the participants so that they are motivated to learn. In other words, participants will be motivated if the training runs smoothly. Ultimately, the training participants will have positive reactions if the participants are satisfied with the training implementation, and vice versa.

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