Knowledge, Mechanical Aptitude, and Age on Dual-Expertise Teacher Competence: A Correlational Study

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Abstract: The present study aimed to investigate relations of prior knowledge, mechanical aptitude, and age to competence of dual-expertise teachers. The study was conducted following a research design of ex-post facto. The samples were 102 dual-expertise teachers. To answer its problems, the study collected the data by using questionnaires, tests, and documentation. The data gathered were then analyzed employing desctiptive analysis, regression analysis, and partial correlation analysis. The study found that (1) there is a relation between the prior knowledge, mechanical aptitude, and age to the competence of dual-expertise teachers; (2) a relation is revealed between the prior knowledge and the competence of dual-expertise teachers; (3) a relation is identified between the mechanical aptitude and the competence of dual-expertise teachers; and (4) a relation is found between the age and the competence of dual-expertise teachers.

Key Words: prior knowledge, mechanical aptitude, age, competence of dual-expertise teachers, *"on-in-on-in"* training model

Abstrak: Penelitian bertujuan untuk mengetahui hubungan kompetensi awal, bakat mekanik, dan usia dengan kompetensi guru keahlian ganda. Penelitian ini menggunakan rancangan penelitian *ex-postfacto*. Sampel penelitian adalah 102 guru keahlian ganda. Pengumpulan data menggunakan kuesioner, tes, dan dokumentasi. Analisis data pada penelitian ini menggunakan analisis deskriptif, analisis regresi ganda, dan analisis korelasi parsial. Hasil penelitian ini adalah: (1) ada hubungan kompetensi awal, bakat mekanik, dan usia dengan kompetensi guru keahlian ganda; (2) ada hubungan kompetensi awal dengan kompetensi guru keahlian ganda sebesar; (3) ada hubungan bakat mekanik dengan kompetensi guru keahlian ganda sebesar; dan (4) ada hubungan usia dengan kompetensi guru keahlian ganda sebesar.

Kata kunci: kompetensi awal, bakat mekanik, usia, kompetensi guru keahlian ganda, model pelatihan *"on–in–on–in"*

INTRODUCTION

Vocational education constitutes a sustainable learning, both in terms of professional work setting or daily life which is related with applicable skills and knowledge (Moran & Rumble, 2004). The objective of vocational education is to prepare an individual to be ready to work (Pavlova, 2009). Thus, to provide a specific place for particular training, Vocational High School was established. As formal educational institution, vocational high school also needs teacher as a learning facilitator of vocational education. Teacher plays an important role on provid-

ing a good quality education (Msangya, Mkoma, & Yihuan, 2016) as well as creating positive vibes of learning (Phin, 2014). A good quality of education and positive vibes of learning enhance vocational productive learning.

Recently, the demand of vocational teacher is increasing. In 2016, the number of vocational teacher in Indonesia reached 296,350; in 2017, the number reached 415,237; in 2018, the number reached 430,683; in 2019 the number reached 481,128; and in 2020, the number reached 492,790 (Ministry of Education and Culture, 2016). The increasing demand of vocational teacher will influence both the quality of

learning and graduates of vocational high school, whether it is long term or short term.

To avoid such dilemma, the government has stipulated recent regulation: Presidential Instruction No. 9 of 2016 regarding the revitalization of vocational high school to improve the quality of vocational teacher. Based on the regulation, to increase the number of productive teacher in vocational high school, government: (1) conduct equal distribution of teacher through dual-expertise and function transfer program; (2) perform open-recruitment of new teacher; and (3) provide outsourcing teacher (Ministry of Education and Culture, 2016). Currently, government could only perform equal distribution of teacher through dual-expertise program. Open-recruitment for new teacher could only be performed if there is an insufficiency of teacher in the educational institution who attend dual-expertise program.

Dual-expertise program allows teacher to transfer their function in school (Ministry of Education and Culture, 2016). It allows a normative-adaptive teacher to serve as productive teacher in vocational high school. The data indicated that there is a huge gap between normative-adaptive teacher and productive teacher; 22% of productive teacher and 78% of normative-adaptive teacher (Ministry of Education and Culture, 2016). In the near future, the transfer function of the teachers will difficult since both acquired different discipline.

The dual-expertise program was conducted around 12 months through On-In-On-In training model. In addition, the teachers need to pursue undergraduate study around four years or more before serving as productive teacher. Further, this program leaves a question regarding some issues which influence the competences acquisition of the teachers during the program.

METHOD

This research used ex-postfacto approach since it intended to examine the independent variable first before examining the dependent one. It took 139 teachers around Malang as research population and took 102 teachers as research sample. The determination was employing formula suggested by Isaac and Michael.

This research employed simple random sampling to determine the sample. Then, it used questionnaire, test items, and documentation to obtain the data. The questionnaire was used to measure the age, the test item was used to examine the mechanical aptitude, while documentation intended to observe initial skill and competences of teacher attending dual-expertise program.

The data obtained were analysed using descriptive analysis, multiple regression analysis, and partial correlation analysis. Prerequisite test should be performed before conducting multiple regression analysis and partial correlation analysis such as (1) normality; (2) linearity; (3) multicollinearity; (4) heteroscedasticity, and (5) autocorrelation.

RESULTS

Table 1 presents descriptive analysis results of teachers' initial competences. The highest score obtained was 76 while the lowest score obtained was 38. Thus, the interval of initial competences variable was 9.5. The descriptive analysis results affirm that the initial competences of the teachers was high. It is further shown by 42 teachers out of 102 classified as high or as much as 42.16%.

According to the mechanical aptitude descriptive results in Table 2, the highest score was 50 and the

Table 1. Descriptive Analysis of Teachers' Initial Competences

No	Interval	Classification	Frequency	Percentage
1	66,6 – 76	Very High	25	24,51%
2	57,1 – 66,5	High	43	42,16%
3	47,6 – 57	Moderate	23	22,55%
4	38 – 47,5	Low	11	10,78%
	Total		102	100%

Table 2. Descriptive Analysis of Teachers' Mechanical Aptitude

No	Interval	Classification	Frequency	Percentage
1	42 – 50	Very High	18	17,65%
2	33 – 41	High	49	48,04%
3	24 – 32	Moderate	31	30,39%
4	14 – 23	Low	4	3,92%
	Total		102	100%

lowes score was 14. Thus, it obtained an interval of score of 9. Based on the descriptive results, teachers' mechanical aptitude in Malang was classified high. It was proven by 49 teachers out of 102 who classified as high or as much as 48.04%.

Table 3 presents descriptive analysis results of teachers' age. The highest score obtained was 59 while the lowest score obtained was 29. Thus, the interval of age variable was 7.5. The descriptive analysis results affirm that the age of the teachers was moderate. It is further shown by 33 teachers out of 102 classified as moderate or as much as 32.35%.

Table 4 presents descriptive analysis results of teachers' competences. The highest score obtained was 88.78 while the lowest score obtained was 70.05. Thus, the interval of initial competences variable was 4.68. The descriptive analysis results affirm that the competences of the teachers was high. It is further shown by 37 teachers out of 102 classified as high or as much as 36.27%.

Prerequisite Analysis

Table 5, Table 6 and Table 7 respectively show normality, linearity and multicollinearity test results. Based on Table 5, all variables have a significance value above 0.05 which indicates that the data were normally distributed. Based on Table 6, the significance value on linearity was less than 0.05. Thus, the relationship between variables was linear. Table 7 shows the tolerance value above 0.1 and the VIF value below 10. Thus, there was no multicollinearity problem in the data obtained.

Heteroscedasticity test results and Wurbon Durbin values are shown in Table 8 and Table 9, respectively. Heteroscedasticity test results show that the data did not experience heteroscedasticity problems. Autocorrelation Test Results obtained values of more than 1.7383 (dU) and less than 2.2617 (4-dU). This mean that the data do not have autocorrelation problems.

Table 3. Descriptive Analysis Results of Teachers' Age

No	Interval	Classification	Frequency	Percentage
1	51,6 – 59	Very High	19	18,63%
2	45 – 51,5	High	32	31,37%
3	36,6 – 44	Moderate	33	32,35%
4	29 – 36,5	Low	18	17,65%
	Total		102	100%

Table 4. Descriptive Analysis of Teachers' Competences

No	Interval	Classification	Frequency	Percentage
1	84,10 – 88,78	Very High	31	30,39%
2	79,42 – 84,09	High	37	36,27%
3	74,74 – 79,41	Moderate	28	27,45%
4	70,05 – 74,73	Low	6	5,88%
	Total		102	100%

Table 5. Normality Testing

Variable	Significance
Initial Competence	0,400
Mechanical Aptitude	0,164
Age	0,662
Teacher's Competence attending dual-expertise program	0,657

Table 6. Linearity Testing

Variable Correlation	Significance
Initial Competence with Teacher's Competence attending dual-expertise program	0,001
Mechanical Aptitude with Teacher's Competence attending dual-expertise program	0,021
Age with Teacher's Competence attending dual-expertise program	0,048

Table 7. Hasil Uji Multikolinearitas
Multicollinearity Testing

Variable	Tolerance	VIF
Initial Competence	0,882	1,134
Mechanical Aptitude	0,990	1,010
Age	0,875	1,143

Table 8. Heteroscedasticity Test Results

Variable	Significance
Initial competence	0,861
Mechanical aptitude	0,872
Age	0,809

Table 9. Autocorrelation Test Results

Durbin Watson	dU	4 - dU
1,7780	1,7383	2,2617

Multiple Regression Analysis

The Correlation between Initial Competence, Mechanical Aptitude, and Age on Teachers' Competence of Dual-Expertise Program

Based on Table 10, the results of Anova Multiple Linear Regression Analysis obtained significance of less than 0.05. Thus, Ho was rejected. This means that there is a relationship between initial competence, mechanical aptitude, and age with the teacher competences of the dual expertise of the "On-In-On-In" training model in Malang.

Furthermore, based on Table 11. Based on the results of Multiple Model Linear Regression Analysis "Model Summary", the R-Square value was 0.247. This indicates that the initial competence, mechanical aptitude, and age had a contributing influence on the competence of the teacher at 24.7%. While 75.3% was influenced by other variables.

The multiple regression equation based on Table 12 was $Y = 56.133+0.209X1+0.137X2+0.178X3$. The regression equation can be interpreted: (1) without initial competence (X1), mechanical aptitude (X2), and age (X3), the magnitude of the teacher competency output (Y) was 56,133; (2) if X1 increases by one unit, Y output increases by 0.209 units; (3) if X2 increases by one unit, Y output increases by 0.137 units; and (4) for every increase in X3 by one unit, Y output increases by 0.178 units.

Partial Correlation Analysis

The significance value of the initial competency variable based on Table 12 obtained a value of 0,000 ($\rho <0.05$). Thus, it can be concluded that all Ho was rejected. This means that there is an initial competency relationship with the competency of the dual expertise teacher attending "On-In-On-In" training model in Malang. Furthermore, the contribution of the influence of initial competence on the competence of dual expertise teachers was 13.3%. Another, there is a relation-

Table 10. Anova Multiple Linear Regression Analysis

Model		Sum of Square	df	Mean Square	F	Sig.
	Regression	451,048	3	150,349	10,687	,000[b]
1	Residual	1378,714	98	14,069		
	Total	1829,762	101			

a.Dependent Variable: Teachers' Competence of Dual-Expertise Program
b.Predictors: (Constant), Initial Competence, Mechanical Aptitude, and Age

Table 11. The Results of Multiple Model Linear Regression Analysis "Model Summary"

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	,496[a]	,247	,223	3,75080

a. Predictors: (Constant), Initial Competence, Mechanical Aptitude, and Age

Table 12. Coefficients Multiple Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
	(Constant)	56,133	4,502		12,468	,000			
1	Initial competence	,209	,045	,429	4,593	,000	,309	,421	,403
	Mechanical aptitude	,137	,055	,218	2,475	,015	,232	,243	,217
	Age	,178	,052	,323	3,444	,001	,197	,329	,302

a. Dependent Variable: Teachers' Competence of Dual-Expertise Program

ship between mechanical aptitude and the competence of the dual expertise teacher attending "On-In-On-In" training model in Malang. Furthermore, the contribution of the influence of mechanical aptitude to the competence of dual expertise teachers was 5.1%. In addition, the contribution of age's influence on the competency of dual expertise teachers was 6.4%.

DISCUSSION

This study discusses four main points: (1) the ef-fect of initial competency, mechanical aptitude, and age on the competency of dual expertise teachers; (2) the effect of initial competency on the competency of dual expertise teachers; (3) the influence of me-chanical aptitude on the competence of dual expertise teachers; and (4) the effect of age on the competence of dual expertise teachers.

The Correlation between Initial Competence, Mechanical Aptitude, and Age on Teachers' Competence of Dual Expertise Program

Before acquiring more complicated knowledge, it requires an initial knowledge to begin with. Individual with high initial competences employed stronger independent learning process than those with low initial competence (Greene, Costa, Robertson, Pan, & Deekens, 2010). Initial competence explains teachers' understanding upon what will they learn in terms of vocational knowledge.

Mechanical aptitude also influences the achievement of competencies. Aptitude is a natural ability to gain general or special skills and knowledge (Asrori, 2015). Aptitude will further develop individual potential if accompanied by exercises (Pradana, 2014). Individuals with high mechanical aptitude will find it easier to achieve good results than those with low aptitude (Suprianto, Mukhadis, & Mustaman, 2013). Mechanical aptitude possessed by a dual expertise teacher affect the achievement of teacher competence after undergoing training.

In addition, certain and particular competence involves broad knowledge and understanding and it is well-organized. A person's age is an indication of how much competence they have. Being an "expert" in a field usually requires years of experience, learning, and effort (Santrock, 2012). Therefore, it takes years to become competent. Based on several previous theories, initial competency, mechanical aptitude, and age are thought to have an influence on the achievement

of the dual expertise teacher's competency in "On-In-On-In" training model.

According to Uno (2014), factors that influence competence, are: (1) innate factors, such as mechanical aptitude; and (2) training factors, such as training experience. In addition, the competency of an individual is also determined by the knowledge gained based on information. The information is obtained by individuals to increase their knowledge, thus forming the individual's initial competence.

Hailikari, Nevgi, and Ylänne (2007) emphasized that the factors that influence achievement have been the focus of many educational psychologists for decades. Almost all educational studies conducted at that time recognized the importance of initial competence in the learning process and outcomes. Greene et al., (2010) describe individuals who have high initial competencies using high quality independent learning processes compared to individuals with low initial competencies.

According to Xiaofeng, Xiao-e, Yanru, and AiBao (2016), individuals who have different initial competency levels have different learning outcomes even though the material and learning strategies are identical. The initial competence is thought to influence the learning outcomes of multiple expertise teachers. The learning outcomes can be seen from the competencies achieved. Based on this, dual expertise teachers with good initial competence will find it easier to achieve competencies taught in the dual expertise program.

According to Asrori (2015), aptitude allows individual to achieve in certain fields. However, it requires practice, knowledge, experience, and motivation. Shanmugam (2016) explains that aptitude is shown in interest and reflected in behavior that is expected to be increased along with the training obtained. Aptitude can also be a measure of a candidate's expertise in a variety of specific fundamental skills. Based on this, the dual expertise teacher who has good mechanical aptitude will easily master the competencies taught in the program.

On the other hand, the age factor also indicates how good the initial competence and mechanical aptitude of a teacher. That is because having good initial competence, training experience, teaching experience, and mechanical aptitude take a long time. According to Desmita (2006), cognitive abilities continue to develop during adulthood. Someone who is more mature in terms of age, the opportunity to increase competence is more wide open. Based on this, teacher participating in the dual expertise program is expected to

be mature in terms of age, because age maturity influences initial competency, training experience, teaching experience, and mechanical aptitude possessed by the teacher. Initial competence, training ex-perience, teaching experience, mechanical aptitude, and age were correlated with teachers' competences attending dual expertise training model "On-In-On-In" in Malang. In addition, the contribution of the influence of initial competency variables, mechanical aptitude, and age on the competence of dual expertise teachers was 24.7%. The results of this study support similar studies that have been carried out, including: (1) Rahmat's research results (2016) which states there are differences of learning outcomes between individuals with high initial ability and individuals with low initial ability; (2) the results of Huda's research (2017) which conclude that mechanical aptitude directly contributed positively and significantly to the achievement of vocational competence; and (3) Zhang's research (2010) which states there is a relationship between age and ability or competence.

Based on this research results, relevant research results, and expert opinion, initial competence, training experience, teaching experience, mechanical aptitude, and age were correlated with teachers' competences attending dual expertise training model "On-In-On-In" in Malang. The higher the initial competence, mechanical aptitude, and age possessed by the dual expertise teacher, the teacher competency will be higher. Conversely, the lower the initial competency, mechanical aptitude, and age possessed by the teacher, the competency will be lower.

The Correlation of Initial Competence on Teachers' Competence Attending Dual Expertise Program

According to Williams and Lombrozo (2013), learning tends to bring about challenging inductive problems, and initial competence gives important cues to patterns that tend to have a broad reach. According to Almeida, López, Ballesteros, & Pérez (2012), initial competency reinforce learning, because the memory is developed through associative learning, in a manner recalling the events related to the concepts that have been there before. All of this underlies the relationship between initial competence and academic success

In addition, Amadieu, van Gog, Paas, Tricot, and Mariné (2009) explain the level of initial competence is a variable that has a strong relationship with learning

outcomes. Based on Gurlitt and Renkl (2010), the initial competency level affect all other learning variables, and the effect size for learning outcomes is around 30% to 60%. Xiaofeng et al. (2016) explains that individuals who have higher initial competence will be able to understand new content better, compared to individuals who have low initial competency levels

Taub, Azevedo, Bouchet, and Khosravifar (2014) assert that individuals with high initial competence will be more effective in managing their own learning, compared to individuals who have low initial competency, because these individuals have more relevant knowledge that allows them to acquire new knowledge to existing knowledge. According to Hailikari et al. (2007), studies have also shown that initial competencies in certain fields specifically affect individual achievement. About 95% of all studies focusing on initial competencies show a positive effect.

According to Braithwaite and Goldstone (2015), related to the lack of knowledge in a particular field, individuals who are more knowledgeable will be more sensitive to the structural characteristics that are relevant. Wetzels, Kester, and Van Merriënboer (2011) describe the activation of initial competencies as having a strong facilitative effect on learning. Hailikari et al. (2007) states the differences of each individual on the basis of initial competence is the main source of the emergence of differences in individual achievement. Especially, individuals who lack certain initial competencies will face difficulties in learning new information.

The contribution of the influence of the initial competency variable on the competency of the teacher attneding dual expertise program was 13.3%. The results of this study are similar to Rahmat's (2016) study which concluded that there are differences in the learning outcomes of individuals with high initial ability and low initial ability. Individuals with high initial ability tend to have high learning outcomes and vice versa. Other studies conducted by Hailikari et al. (2007) states that there is an influence of initial competence in certain fields on individual achievement. Based on the research results, relevant research results, and expert opinion, there is a relationship of initial competence with the competency of the teacher attending dual expertise program through "On-In-On-In" training model in Malang. The higher the initial competency of the teacher, the higher the competency of the teacher.

The Correlation of Mechanical Aptitude on Teachers' Competence Attending Dual Expertise Program

According to Anwar, Sudjimat, and Suhartadi (2009), mechanical aptitude is a factor that determines learning outcomes. Furthermore, Anwar et al. (2009) explain that aptitude is innate. It is the initial capital and potential that already exists and is inherent within individuals. In addition, Shanmugam (2016) explains that aptitude is shown in individual's interest and reflected in current behavior that is expected to increase along with the training obtained. Aptitude can also be a measure of a candidate's expertise in a variety of specific fundamental skills. Firdaus (2014) asserts that the competency or professionalism of a teacher can be influenced by innate factors or aptitudes.

According to Murjoko (2016), aptitude enables individuals to achieve, but it requires training, experience, knowledge and motivation. Almeida et al. (2012) assert that based on a literature review also shows that aptitude influences academic success. In addition, Suprianto et al. (2013) also emphasizes that mechanical aptitude influences learning achievement, both directly and indirectly. Furthermore, Mustaman (2009) states that individuals who have aptitude in the field of engineering, are easier to understand the working principle of machines, machine planning, understanding job sheets, and faster in performing disassembly, installation, looking for interference with the machine. In addition, aptitude is a condition in individuals, where with special training will create knowledge, and special skills.

The contribution of the influence of mechanical aptitude variable on the competence of teachers was obtained by 5.1%. The results of this study are similar to Huda (2017) which states that mechanical aptitude contributes positively, significantly, and directly to the achievement of vocational competence. Other research conducted by Rohman (2014) states that there is a relationship between mechanical aptitude with the achievement of competence. A similar study was also conducted by Zunaidi (2015), there were differences in learning outcomes of the angular connections welding between individuals who had high mechanical aptitude classifications and individuals with low mechanical aptitude classifications. In addition, similar research was also conducted by Qolik and Putro (2010) which stated there was a relationship between mechanical aptitude and pedagogical competence. Based on the research results, relevant research results, and expert opinion, there is a relationship between mechanical aptitude and the competence of the teacher attending dual expertise program through "On-In-On-In" training model in Malang. The higher the mechanical aptitude possessed, the higher the teacher's competency will be.

The Correlation of Age on Teachers' Competence Attending Dual Expertise Program

Khodijah (2016) explains the development process experienced by humans through the stages of development includes various aspects, both physical, motor, intelligence, emotional, social, and etc. Each aspect develops in due time in accordance with the rhythm and speed of development and learning process that is passed by every human being. The development experienced vary between individuals. However, the stages of development are passed in sequence, not jumping around. The initial life is the basis for later periods. According to Salkind (2015), since age can be determined easily and accurately, the development of an individual is often judged by the person's ability compared to certain ability criteria expected at a certain age. The most commonly used normative or comparative measurement is the age at which a number of individuals in a certain percentage can perform at a certain level.

Furthermore, Santrock (2012) describes a competency or expertise involving broad and highly organized knowledge and understanding of a particular field. Developing expertise and becoming an "expert" in a field is usually the result of years of experience, learning and effort. A person's age can be an indication of how much competency a person has, because it takes years to become competent.

In addition, Desmita (2006) asserts that adult individuals are more advanced than individuals who are still teenagers related to the application of intellect. Individuals in early adulthood usually change from the stage of seeking knowledge to the stage of applying knowledge, that is applying what is known in achieving career paths. Based on this, the more mature age a teacher has, then in terms of achievement and mastery of the competence of the teacher has enough time to improve the competencies held as a teacher.

Furthermore, Sary (2015) also emphasized that during adulthood cognitive abilities continue to develop. However, cognitive changes in early adulthood do not all lead to increased competence. Some experts believe that in late adulthood cognitive skill decline can be increased through certain training. Therefore, teachers

who have an adult age can be trained again to improve the competencies that have been achieved before.

Hypothesis test results in this study indicate that the age variable has a significance of 0.001 ($p < 0.05$). That is, it can be said that there is a relationship between age and the competence of the dual expertise teacher "On-In-On-In" training model in Malang City. In addition, the contribution of the influence of age variables on the competence of dual expertise teachers was obtained at 6.4%. The results of this study are supported by the research of Schripsema and Trigt (2017) which concludes there is a positive relationship between age and achievement. Research conducted by Zhang (2010) also concluded that there was a relationship between age and ability or competence. In addition, research conducted by Latif (1993) also concluded that there was a positive and significant relationship between age and success in carrying out tasks.

Based on the results of research that have been analyzed by researchers, relevant research results, and expert opinion, it can be concluded that there is a relationship of age with the competence of the dual expertise teacher "On-In-On-In" training model in Malang City. The more mature the age of the dual expertise teacher, the higher the competency of the teacher. Conversely, the younger the age that a dual expertise teacher has, the less competent the teacher has.

CONCLUSION

This study has concluded that the initial competency of dual expertise teachers in Malang is included in the high category by 42.16%. The mechanical aptitude of dual expertise teachers in Malang is included in the high category by 48.04%. in the medium category 32.35% competency of dual expertise teachers in Malang is included in the high category of 36.27%. There is a relationship between initial competence, mechanical aptitude, and age with competency of dual expertise teachers; (6) there is a relationship between initial competence and competence of dual expertise teachers. There is a relationship between mechanical aptitude and competence of dual expertise teachers. There is an relationship between age and competence of dual expertise teachers.

The Ministry of Education and Culture is expected to be able to make policies regarding additional requirements for participating in a dual expertise program. The Malang City Education Office is expected

to be able to take policies regarding the fulfillment and improvement of the quality of Vocational School earning teachers in Malang in the form of an appeal for adaptive and normative teachers in Vocational Schools and High Schools in Malang to participate in participating in a dual expertise program. Malang City Vocational School is expected to be able to take a policy on the assignments to be given to dual expertise teachers. For teachers, the results of this study can provide understanding for teachers who will register for dual skills programs. Initial competency, mechanical aptitude and age are needed to become dual skills teachers. For researchers, the results of this study can be a reference and consideration in carrying out similar research on multiple expertise programs.

REFERENCES

Almeida, D. J. G., Hernández-López, L., Ballesteros, J. L., & De Saá-Pérez, P. (2012). Motivation and prior knowledge as determinants of knowledge assimilation: Explaining the academic results of tourism students. *Journal of Hospitality, Leisure, Sport and Tourism Education*, *11*(2), 151–160. https://doi.org/10.1016/j.jhlste.2012.04.002.

Amadieu, F., van Gog, T., Paas, F., Tricot, A., & Mariné, C. (2009). Effects of prior knowledge and concept-map structure on disorientation, cognitive load, and learning. *Learning and Instruction*, *19*(5), 376–386. https://doi.org/10.1016/j.learninstruc.2009.02.005.

Anwar, K., Sudjimat, D. A., & Suhartadi, S. (2009). Pengaruh media pembelajaran dua dimensi, tiga dimensi, dan bakat mekanik terhadap hasil belajar sistem pengapian motor bensin di SMK kota Mojokerto. *Teknologi Kejuruan*, *32*(2), 141–151.

Asrori. (2015). *Perkembangan peserta didik: Pengembangan kompetensi pedagogis guru*. Yogyakarta: Media Akademi.

Braithwaite, D. W., & Goldstone, R. L. (2015). Effects of variation and prior knowledge on abstract concept learning. *Cognition and Instruction, 33*(3), 226–256. https://doi.org/10.1080/07370008.2015.1067215.

Desmita. (2006). *Psikologi Perkembangan*. Bandung: PT Remaja Rosdakarya.

Firdaus, D. (2014). Pengaruh tingkat pendidikan, pelatihan, dan pengalaman mengajar terhadap profesionalitas guru di madrasah tsanawiyah negeri Kediri 2. *Didaktika Religia*, *2*(2), 159–181.

Greene, J. A., Costa, L. J., Robertson, J., Pan, Y., & Deekens, V. M. (2010). Exploring relations among college students' prior knowledge, implicit theories of intelligence, and self-regulated learning in a hypermedia

environment. *Computers and Education*, *55*(3), 1027–1043. https://doi.org/10.1016/j.compedu.2010.04.013

Gurlitt, J., & Renkl, A. (2010). Prior knowledge activation: How different concept mapping tasks lead to substantial differences in cognitive processes, learning outcomes, and perceived self-efficacy. *Instructional Science*, *38*(4), 417–433. https://doi.org/10.1007/s11251-008-9090-5

Hailikari, T., Nevgi, A., & Ylänne, S. L. (2007). Exploring alternative ways of assessing prior knowledge, its components and their relation to student achievement: A mathematics based case study. *Studies in Educational Evaluation*, *33*(3), 320–337. https://doi.org/10.1016/j.stueduc.2007.07.007

Huda, K. (2017). *Kontribusi bakat mekanik dan kreativitas terhadap problem solving skill serta dampaknya pada pencapaian kompetensi kejuruan siswa paket keahlian teknik permesinan di kota Malang* (Unpublished master's thesis). Universitas Negeri Malang, Indonesia.

Kementerian Pendidikan dan Kebudayaan. (2016). *Pedoman program sertifikasi keahlian dan sertifikasi pendidik bagi guru SMK/SMA (keahlian ganda)*. Jakarta: Direktorat Jenderal Guru dan Tenaga Kependidikan.

Khodijah, N. (2016). *Psikologi pendidikan*. Jakarta: PT Rajagrafindo Persada.

Latif, M. A. (1993). *Hubungan antara latar belakang pendidikan, usia dan masa jabatan dengan keberhasilan melaksanakan tugas penilik pendidikan masyarakat di kabupaten dati II Malang* (Unpublished master's thesis). Universitas Negeri Malang, Indonesia.

Moran, L., & Rumble, G. (2004). *Vocational education and training through open and distance learning*. London: RoutledgeFalmer.

Msangya, B. W., Mkoma, S. L., & Yihuan, W. (2016). Teaching practice experience for undergraduate student teachers: A case study of the department of education at Sokoine University of Agriculture, Tanzania. *Journal of Education and Practice*, *7*(14), 113–118.

Murjoko, B. (2016). Pengaruh bakat mekanik, tingkat pemahaman teori pemesinan dan prestasi praktik pemesinan terhadap kesiapan kerja. *Jurnal Pendidikan Vokasional Teknik Mesin*, *4*(8), 591–596.

Mustaman. (2009). Korelasi bakat mekanik, prestasi praktikum otomotif, dan prestasi praktik industri dengan hasil uji kompetensi servis berkala otomotif roda empat mahasiswa program studi pendidikan teknik otomotif. *Teknologi Dan Kejuruan*, *16*(4), 733–743. https://doi.org/10.1161/01.STR.32.1.139

Pavlova, M. (2009). *Technology and vocational education for sustainable development: Empowering individuals for the future*. Australia: Springer.

Phin, C. (2014). Teacher competence and teacher quality in Cambodias educational context linked to in-service teacher training: an examination based on a questionnaire survey. *International Journal of Educational Administration and Policy Studies*, *6*(4), 62–69. https://doi.org/10.5897/IJEAPS2013.0326

Pradana, A. W. (2014). Kesiapan kerja siswa teknik pemesinan ditinjau dari bakat. *E-Jurnal Pendidikan Teknik Mesin*, *2*(3), 157–164.

Qolik, A., & Putro, S. C. (2010). Hubungan bakat mekanik dan motivasi keguruan dengan kompetensi pedagogik di bidang pemesinan mahasiswa program studi s1 pendidikan teknik mesin FT-UM. *Teknologi dan Kejuruan*, *33*(2), 143–150.

Rahmat, M. H. (2016). *Pengaruh model pembelajaran dan kemampuan awal terhadap hasil belajar mata pelajaran teknik pemesinan frais siswa SMK* (Unpublished master's thesis). Universitas Negeri Malang, Indonesia.

Rohman, M. (2014). *Hubungan bakat mekanik, prakerin dan persepsi terhadap kinerja guru dengan pencapaian kompetensi siswa SMK* (Unpublished master's thesis). Universitas Negeri Malang, Indonesia..

Salkind, N. J. (2015). *Teori-teori perkembangan manusia: Sejarah kemunculan, konsepsi dasar, analisis komparatif, dan aplikasi*. Bandung: Nusa Media.

Santrock, J. W. (2012). *Life-span development: Perkembangan masa hidup edisi ketigabelas jilid 2*. New York: Erlangga.

Sary, Y. N. E. (2015). *Psikologi pendidikan*. Yogyakarta: Parama Publishing.

Schripsema, N. R., & Trigt, A. M. Van. (2017). Impact of vocational interests, previous academic experience, gender and age on Situational Judgement Test performance. *Advances in Health Sciences Education*, *22*(2), 521–532. https://doi.org/10.1007/s10459-016-9747-9

Shanmugam, L. (2016). A study on differential aptitude and teaching competency of student teachers in Kancheepuram district. *Journal of Education and Practice*, *7*(13), 87–88.

Suprianto, A. D., Mukhadis, A., & Mustaman. (2013). Pengaruh model pembelajaran problem based learning (PBL) dan bakat mekanik terhadap hasil belajar siswa kelas x mata pelajaran sistem bahan bakar sepeda motor program keahlian teknik sepeda motor di SMK PGRI 3 Malang. *Jurnal Teknik Mesin*, *21*(2), 145–157.

Taub, M., Azevedo, R., Bouchet, F., & Khosravifar, B. (2014). Can the use of cognitive and metacognitive self-regulated learning strategies be predicted by learners' levels of prior knowledge in hypermedia-learning environments? *Computers in Human Behavior*, *39*, 356–367. https://doi.org/10.1016/j.chb.2014.07.018

Uno, H. B. (2014). *Profesi kependidikan: Problema, solusi, dan reformasi pendidikan di Indonesia.* Jakarta: PT Bumi Aksara.

Wetzels, S. A. J., Kester, L., & Van Merriënboer, J. J. G. (2011). Adapting prior knowledge activation: Mobilisation, perspective taking, and learners' prior knowledge. *Computers in Human Behavior*, *27*(1), 16–21. https://doi.org/10.1016/j.chb.2010.05.004

Williams, J. J., & Lombrozo, T. (2013). Explanation and prior knowledge interact to guide learning. *Cognitive Psychology*, *66*(1), 55–84. https://doi.org/10.1016/j.cogpsych.2012.09.002

Xiaofeng, M., Xiao-e, Y., Yanru, L., & AiBao, Z. (2016). Prior knowledge level dissociates effects of retrieval practice and elaboration. *Learning and Individual Differences*, *51*, 210–214. https://doi.org/10.1016/j.lindif.2016.09.012

Zhang, L. (2010). Do age and gender make a difference in the relationship between intellectual styles and abilities/ ?, 87–103. https://doi.org/10.1007/s10212-009-0006-9

Zunaidi. (2015). *Pengaruh strategi pembelajaran dan bakat mekanik terhadap hasil belajar kompetensi sistem pengapian mesin di SMK bagian keahlian mekanik otomotif* (Unpublished master's thesis). Universitas Negeri Malang, Indonesia.