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ANALYSIS OF FACTORS AFFECTING THE COMPETENCY OF PHYSICS TEACHERS IN WEST SUMATRA PROVINCE

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Abstract: Teachers' competency plays a vital role in improving the quality of their teaching. Hence, this research was performed to analyse the factors affecting the Competency of Physics teachers in West Sumatra Province. This research employs a quantitative research design with a survey method. A total of 37 Physics teachers from junior and senior high schools in West Sumatra Province were selected as respondents of the research using the purposive sampling technique. A questionnaire was used as the primary instrument for this research. The finding indicated that most respondents agreed that a physics teacher's pedagogical, social, personality and professional competencies in West Sumatra Province were significantly influenced by the self-concept (95%) and communication skills (100%). The respondents also suggested that Physics teachers should have digital literacy skills and support from school management to improve their competency level. The findings of this study can be used as a reference to develop the competency model of a Physics teacher in West Sumatra Province.

Keywords: Factors Analysis, Teacher's Competency, Physics Teachers

Abstrak: Kompetensi guru memainkan peran penting dalam meningkatkan kualitas pengajaran mereka. Oleh karena itu, penelitian ini dilakukan untuk menganalisis faktor-faktor yang memengaruhi kompetensi guru Fisika di Provinsi Sumatera Barat. Penelitian ini menggunakan desain penelitian kuantitatif dengan metode survei. Sebanyak 37 guru Fisika dari sekolah menengah pertama dan atas di Provinsi Sumatera Barat dipilih sebagai responden penelitian dengan menggunakan teknik purposive sampling. Kuesioner digunakan sebagai instrumen utama dalam penelitian ini. Hasil penelitian menunjukkan bahwa sebagian besar responden setuju bahwa kompetensi pedagogik, sosial, kepribadian, dan profesional guru Fisika di Provinsi Sumatera Barat sangat dipengaruhi oleh konsep diri (95%) dan kemampuan komunikasi (100%). Responden juga menyarankan agar guru Fisika memiliki keterampilan literasi digital dan dukungan dari manajemen sekolah untuk meningkatkan tingkat kompetensi mereka. Temuan penelitian ini dapat digunakan sebagai referensi untuk mengembangkan model kompetensi guru Fisika di Provinsi Sumatera Barat.

Kata kunci: Analisis Faktor, Kompetensi Guru, Guru Fisika

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INTRODUCTION

Competence refers to a person's ability to provide satisfactory performance in the workplace, to transfer and apply their skills with their knowledge. Spencer and Spencer (1993) introduced the Iceberg Competency Model, which consists of two main parts: the visible part above the surface, namely knowledge and skills, and the invisible part below the surface, which includes values, attitudes, motivations, and personal characteristics.

This model has been a reference to the competency model of various occupations, including administrative staff (Han & Mhunpiew), nurses (Michibayashi, et al., 2020), teachers (Ab Halim, et al., 2021).

Teachers' competency is one of the critical factors in improving the quality of education (Hakim, 2015; Ahyani, et al., 2024). According to the provisions of Law Number 14 of 2005 concerning Teachers and Lecturers, the Indonesian teacher's competency consists of pedagogical, personality, social, and professional competencies. Pedagogical competency refers to the ability of teachers to manage student-centred learning to achieve learning objectives. Meanwhile, personality competency is the ability to have a solid personality, noble character, wisdom, and authority, and to be a role model for students. This personality ability is carried out through reflection in carrying out responsibilities as a teacher under the professional code of ethics, and is oriented towards students. The third competency is social competency, which refers to teachers' ability to communicate effectively and efficiently with students, fellow teachers, parents/guardians of students, and the surrounding community. Meanwhile, professional competency is the ability to master the material to set learning objectives and organise the content of student-centred learning.

Physics is one of the challenging subjects for students to learn since it contains complex and abstract concepts (Molz, Kuhn, & Müller, 2022). Hence, Physics teachers require several additional skills to improve the quality of content delivery to students, such as the ability to express opinions and be a listener, competence in understanding concepts, laws and theories of physics, managerial competence in managing classes, digital competence, assessment competence, managerial and leadership competence, soft skills, moral and character competence, and adaptive competence. These competencies have significant impacts on the teacher’s competency, especially for Physics teachers, as a complexity of competent elements or having balanced skills and knowledge (Yuberti, 2015).

Some countries already introduced a teacher's competency model for their Physics teachers. Finland proposed that Physics teachers should be competent in technology (Jons & Airey, 2024). Meanwhile, Physics teachers in China should participate in the self-development programs for 4 years before becoming a Physics teacher in school. (Zhai, et al., 2020). In contrast, Indonesia has yet to introduce the national Physics teachers'

competency model as a reference for the Indonesian Physics teacher. Hence, the four competencies that have been regulated by law could be influenced by several factors to meet the conditions and morphology of each region in Indonesia according to the local wisdom, the level of human resources, and the economy of each province.

Based on previous literature, common factors that influence the Indonesian teacher's competency are self-concept (Guritno, Suyono & Sunarjo, 2019), communication skills (Utami, 2019), the distance between teacher's house and school (Simsek & Erdem, 2020) and employment status (Aindra, et al., 2022; Fatmaryanti, et al., 2022). The self-concept is important to encourage and motivate a teacher to become a competent teacher. Meanwhile, communication skill is crucial for a teacher to ensure that students can fully understand the learning content. In addition, the distance between the teacher's house and school could influence the teacher's competency as the teacher has limited time to prepare various instructional materials for teaching and learning sessions if his house is far from his school. The Indonesian teacher's competency is also influenced by employment status as there is a gap in career opportunities for teachers who have civil servant status with non-civil servants or employees with work agreements. This will certainly have an impact on how career opportunities, self-development and a stable economy are obtained by these teachers. However, research has yet to be performed to investigate the factors affecting the competency of Physics teachers in West Sumatra Province.

Hence, this research was carried out to determine the factors affecting the competency of Physics teachers in West Sumatra Province. Four factors were investigated in this study: (1) self-concept, (2) communication skills, (3) the distance between the teacher's house and school, and (4) employment status. The primary data collection of this research was a questionnaire, followed by an interview session to gather in-depth explanations related to their responses to the questionnaire.

METHOD

Research Design

This research employs the quantitative research design in the form of a survey. The survey method was selected to collect data within a short period due to its lower costs, ability to reach the masses, and easy application (Gürbüz, 2017; Ponto, 2015; Taherdoost, 2021). The survey data was then verified using the qualitative method in the form of a

semi-structured interview. The interview method was chosen because it allows researchers to collect qualitative data that connects researchers with respondents directly, making it easier to understand their opinions, arguments and behaviour. The interview method is also very effective in getting a more in-depth explanation of complex or complicated topics to produce detailed information in data collection by interviewers or researchers from respondents (Taherdoost, 2021).

Research Population and Samples

This research population consisted of Physics teachers from junior and senior high schools in West Sumatra Province. It employed the purposive sampling technique because the sample should have more than five years of experience teaching Physics in these schools.

Research Instruments

The instruments of this research were a questionnaire and an interview protocol. According to previous research, common factors that influence the Indonesian teacher's competency are self-concept (Guritno, Suyono & Sunarjo, 2019), communication skills (Utami, 2019), the distance between teacher's house and school (Simsek & Erdem, 2020) and employment status (Aindra, et al., 2022; Fatmaryanti, et al., 2022). Therefore, the questionnaire and interview protocol questions were developed for five aspects: (1) teacher's competency, (2) self-concept, (3) communication skills, (4) distance between the teacher's house and school, and (5) employment status. The interview protocol was prepared to gather in-depth information about their responses to the questionnaire. Table 1 lists the questions for the questionnaire and interview protocol.

Table 1. Questions for the questionnaire and interview protocol

No	Aspect	Questions	
		Questionnaire	**Interview protocol**
1	Teacher's competency	1. Is the performance of a physics teacher determined by his pedagogical, social, personality, and professional competencies?	1. How do the pedagogical, social, personality, and professional competencies of a physics teacher determine his performance?

No	Aspect	Questions	
		Questionnaire	Interview protocol
2	Self-concept	1. Does the self-concept of a physics teacher influence pedagogical, professional, personality and social competence?	1. How does the self-concept of a physics teacher influence pedagogical, professional, personality and social competence?
3	Communication skill	1. Is the communication factor necessary to support the competence of a physics teacher?	1. What kind of communication does a physics teacher need? 2. What kind of communication factors hinder or support a Physics teacher to have good competence and communication during physics learning?
4	Distance between teacher's house and school	1. Does the distance to school affect the competence of a physics teacher?	1. How does the communication factor support the competence of a physics teacher?
5	Employment status	1. Does the status factor of civil servants or non-civil servants influence the competence of a physics teacher?	1. How does the distance to school affect the competence of a physics teacher?
6	Other factors		1. In your opinion, what other factors affect the competency of a physics teacher besides pedagogical, social, personality and professional competencies?

Data Collection Technique

First, Physics teachers of junior and senior high schools in West Sumatra Province were contacted and asked about their willingness to participate in this research. Next, the questionnaire was distributed to them, and they were asked to fill it in. After that, the respondents were interviewed during the interview session.

Data Analysis Technique

The data from the questionnaire was analysed using descriptive statistical analysis to determine the frequency and percentage of the responses for each question. Meanwhile, the data from the interview session was analysed using thematic analysis according to

five themes: (1) general teacher competency, (2) self-concept, (3) communication skill, (4) distance between the teacher's house and school, and (5) employment status.

RESULT AND DISCUSSION

Demography of Respondents

The research sample consists of 37 Physics teachers from junior and senior high schools in West Sumatra Province who volunteered to participate. Table 2 shows the distribution of respondents from each city and regency in West Sumatra Province.

Table 2. Number of respondents from each city and regency in West Sumatra Province

City/Regency	Number of respondents, *N*
Solok City	14
Padang City	2
South Solok regency	8
Sijunjung regency	2
Dharmasraya regency	3
Solok regency	1
50 Kota regency	1
South Pesisir regency	2
West Pasaman regency	1
Pasaman regency	1
Padang Pariaman regency	1
Agam regency	1
Total	**37**

Factors Affecting The Competency of Physics Teachers in West Sumatra Province

Table 3 summarises the respondents' responses to each question in the questionnaire. The finding indicated that most respondents agreed that a Physics teacher's performance in West Sumatra Province was determined by his competency ($N = 34$, 92%). Meanwhile, most respondents agreed that the self-concept ($N = 35$, 95%) and communication skills ($N = 37$, 100%) significantly affect the competency of Physics teachers in West Sumatra Province. In contrast, most respondents suggested that the

distance between school and teacher's house (N = 25, 67%) and employment status (N = 25, 67%) did not affect the competency of Physics teachers.

Table 3. Responses of respondents for each question in the questionnaire

No.	Aspect	Questions	No. of respondents, *N* (%)		
			Yes	No	Not sure
1	Teacher's competency	Is the performance of a physics teacher determined by his pedagogical, social, personality, and professional competencies?	34 (92)	2 (5)	1 (3)
2	Self-concept	Does the self-concept of a physics teacher influence pedagogical, professional, personality and social competence?	35 (95)	2 (5)	0 (0)
3	Communication skill	Is the communication factor necessary to support the competence of a physics teacher?	37 (100)	0 (0)	0 (0)
4	Distance between teacher's house and school	Does the distance to school affect the competence of a physics teacher?	10 (27)	25 (67)	2 (5)
5	Employment status	Does the status factor of civil servants or non-civil servants influence the competence of a physics teacher?	10 (27)	25 (67)	2 (5)

Teacher Competency

According to Table 3, 95% of respondents agreed that the performance of a Physics teacher was determined by their pedagogical, social, personality, and professional competencies. All four competencies have a significant effect on the performance of Physics teachers, as explained by R11:

> R11: "Good pedagogical competence will make teachers more focused in delivering teaching material to students. Good social competence enables a teacher to interact better with colleagues and students. Good personal competence allows a teacher to become a good role model for both students and colleagues. Good professional competence certainly greatly influences a teacher's performance, as it is related to the knowledge they specialize in

> and teach. The better the teacher's professionalism, the deeper the knowledge taught to students will be." (*Kompetensi pedagogik yang baik akan menjadikan guru lebih terarah dalam penyampaian materi ajar kepada murid. Kompetensi sosial yang baik menjadikan seorang guru lebih baik dalam berinteraksi dengan rekan sejawat dan murid. Kompetensi kepribadian yang baik dapat menjadikan guru menjadi contoh yang baik bagi murid dan rekan sejawat. Kompetensi profesional yang baik tentulah sangat mempengaruhi dalam kinerja guru hal ini berkaitan dengan ilmu yang ditekuni dan diajarkan. Semakin baik profesional guru, kedalaman ilmu yang diajarkan ke murid semakin bagus.*)

Hence, they suggested that Physics teachers should master all four competencies as it will improve their quality of teaching and maximise the content delivery to students, as explained by R5:

> R5: "Teachers must master the four competencies—pedagogical, social, personal, and professional—as they will have a greater impact on student learning outcomes. If these four competencies are not continuously developed, it will affect the quality of teaching and student learning outcomes." (*Guru harus menguasai keempat kompetensi pedagogik, sosial, kepribadian dan profesional akan memberi dampak lebih besar untuk hasil belajar siswa, jika keempat kompetensi tersebut tidak selalu diasah maka akan memengaruhi kualitas dalam mengajar dan hasil belajar siswa*.)

Therefore, factors affecting all four teachers' competencies - pedagogical, social, personality, and professional - should be determined as they will significantly contribute to a teacher's performance.

Factor 1: Self-concept

The findings indicated that 95% of respondents agreed that the self-concept affects the competency of Physics teachers, as shown in Table 3. The self-concept plays a significant role in creating an effective learning environment, as explained by R3:

> R3: "...important for personal development and academic understanding for teachers to create an effective and inspiring learning environment" (*...penting untuk pengembangan diri dan peningkatan pemahaman*

akademis bagi guru untuk menciptakan lingkungan belajar yang efektif dan inspiratif).

Hence, the teacher with a strong self-concept will be motivated to enhance his knowledge and boost his confidence in teaching, as explained by R8:

> R8: "Teachers who have a strong academic self-concept will be more confident in teaching, continue to develop their knowledge, and are motivated to provide quality teaching (*Guru yang memiliki konsep diri akademis yang kuat akan lebih percaya diri dalam mengajar, terus mengembangkan pengetahuannya, dan termotivasi untuk memberikan pengajaran yang berkualitas*).

In contrast, the low self-concept will have negative impacts on his pedagogical, professional, personality and social competence, as explained by R29:

> R29: "…will affect pedagogical competence if a teacher is unable to solve problems systematically, professional competence will be disturbed if the teacher has a tendency to give up easily, personality competence will be disturbed if the teacher is dishonest, and social competence will be disturbed if the teacher is not open-minded." (…*akan berpengaruh terhadap kompetensi pendagogik apabila seorang guru tersebut tidak mampu memecahkan masalah secara sistematis, akan terganggu kompetensi profesionalisme apabila memiliki sifat mudah menyerah, akan terganggu kompetensi kepribadian apabila tidak jujur, serta akan terganggu kompetensi sosial apabila tidak berpikiran terbuka*.)

Thus, Physics teachers in West Sumatra Province should have strong self-concepts to improve their competency as Physics teachers.

Factor 2: Communication Skills

According to the findings in Table 3, all respondents (100%) agreed that communication skills will influence the competency of Physics teachers. They suggested that a teacher should employ good communication skills to ensure that students understand the learning materials, as explained by R6:

> R6: "The communication required is the effective communication using language that is easy for students to understand when delivering learning materials." (*komunikasi yang dibutuhkan adalah komunikasi yang baik*

menggunakan bahasa yang mudah dimengerti oleh siswa dalam menyampaikan materi pembelajaran.)

In addition, a teacher with good communication skills will also create an effective learning environment and motivate students to learn, as explained by R8:

> R8: "Good communication allows the teacher to explain physics concepts clearly, motivate students, and create an interactive learning environment." (*Komunikasi yang baik memungkinkan guru menjelaskan konsep fisika dengan jelas, memotivasi siswa, serta menciptakan lingkungan belajar yang interaktif.*)

Furthermore, a teacher should master the verbal and nonverbal communication skills so that the learning materials can be delivered effectively to students, as explained by R36:

> R36: "A teacher needs to have communication skills, both verbal and nonverbal, in order to be effective in delivering lessons" (*Seorang guru perlu memiliki kemampuan berkomunikasi baik secara verbal maupun nonverbal agar dapat efektif dalam menyampaikan pelajaran*.)

Communication skills are also important for a teacher to encourage the sharing of ideas between colleagues, as explained by R11:

> R11: "Apart from students, the teacher can share their knowledge with colleagues…" (*...Selain kepada murid, guru dapat berbagi pengetahuannya dengan rekan sejawat...*)

Therefore, Physics teachers in West Sumatra Province should have good communication skills to enhance their competency as Physics teachers.

Factor 3: Distance Between the Teacher's House And the School

The findings also indicated that 27% of respondents suggested that the competency of Physics teachers was influenced by the distance between the teacher's house and school, as shown in Table 3. The far distance between the teacher's house and school will affect their attendance at school, their involvement in school activities, and their physical or mental conditions, as explained by R8:

> R8: "...distance can affect several factors such as attendance, involvement, and the physical or mental condition of the teacher. Tardiness, which can ultimately decrease their teaching effectiveness." (*...jarak bisa berdampak*

pada faktor-faktor seperti kehadiran, keterlibatan, dan kondisi fisik atau mental guru. keterlambatan, yang pada akhirnya dapat mengurangi efektivitas pengajaran mereka.)

In addition, one of the respondents, R14 shared his experience when he stayed near and far from school:

R14: "…I have experienced it for the past 3 years with a duration of 2.5 hours to school. When I am tired on the way home from school, it will make me less prepared for the next day's learning. From 2019 to 2020, I lived near the school. I really enjoyed carrying out learning every day because every day I could still see the learning plan for the next day. Now the time to review the learning plan for the next day is no longer there, so every time I enter a new class, I can review it, and I feel a little overwhelmed and always feel that learning in class is less than optimal." (*... saya sudah mengalaminya selama 3 tahun terakhir dengan durasi waktu kesekolah 2,5 jam. Ketika sudah capek dijalan pulang sekolah akan membuat saya kurang mempersiapkan diri untuk pembelajaran esok harinya. Tahun 2019 sampai 2020 saya pernah kos di dekat sekolah, saya sangat enjoy menjalankan pembelajaran tiap harinya karena setiap hari saya masih bisa melihat rancangan pembelajaran untuk esok harinya, sekarang waktu untuk meninjau rancangan pembelajaran untuk hari berikutnya sudah tidak ada lagi, jadinya setiap masuk kelas baru saya bisa meninjau sebentar, dan saya merasa sedikit keteteran dan selalu merasa pembelajaran di kelas jadi kurang optimal*.)".

However, most respondents (67%) agreed that the distance between the teacher's house and the school does not affect the competency of Physics teachers, as they suggested that a teacher should manage his time wisely if his house is far from his school, as explained by R6 and R9:

R6: "…if the distance from home to school is far, then as teachers, we must prepare ourselves early to leave home and estimate the travel time that will be taken with the teaching hours." (*...jika jarak dari rumah kesekolah jauh maka sebagai guru kita harus mempersiapkan diri lebih awal berangkat dari*

rumah dan memperkirakan waktu tempuh yang akan dilalui dengan waktu jam masuk mengajar.)

R9: "…because once the placement has been determined, we are required to be professional in our duties, especially in time discipline. If the distance is quite far, the teacher just needs to manage their time and rest well." (…*karena saat penempatan telah ditetapkan, kita dituntut untuk profesional dalam tugas, terutama pada disiplin waktu, jika jarak cukup jauh, guru hanya perlu mengatur waktu dan istirahat dengan baik*.)

Thus, the competency of a Physics teacher in West Sumatra Province is independent of the distance between a teacher's house and school as the teacher should manage his time wisely.

Factor 4: Employment Status

The findings in Table 3 also indicated that most respondents (67%) agreed that the employment status does not affect the competency of Physics teachers. It could be due to both civil and non-civil servant teachers sharing the same responsibilities towards their students as explained by R6:

R6: "…because the duties and responsibilities of a teacher are not dependent on their employment status, meaning they have the same duties and responsibilities towards the students" (…*karena tugas dan tanggung jawab seorang guru tidak tergantung kepada status kepegawaiannya yaitu memiliki tugas dan tanggung jawab yang sama terhadap peserta didik.*)

The competency of a teacher was significantly influenced by his motivation, pedagogy, and professionalism, as explained by R1, R16 and R8:

R1: "…because the competence of a physics teacher is more based on his personal motivation …" (…*karena kompetensi guru fisika lebih pada motivasi pribadi seorang guru*…)

R16: "…because the material taught in the classroom is the same, the only distinguishing factor is the teaching method, which is different." (…*karena materi yang diajarkan sama didalam kelas hanya faktor pembedanya cara mengajarnya sama yang berbeda.*)

> R8: "…because a teacher's competence depends more on their education, experience, and professional training." (*...karena kompetensi guru lebih bergantung pada pendidikan, pengalaman, dan pelatihan profesional yang mereka miliki*.)

However, the low motivation to enhance their competency could be caused by their employment status, as explained by R2:

> R2: "…because non-civil servant teachers do not have a permanent employment status, non-civil servant teachers have less motivation to improve their competencies." (*…karena guru Non PNS tidak memiliki status kepegawaian yang tetap sehingga guru non PNS kurang motivasi untuk meningkatkan kompetensinya*.)

Then, it can be concluded that the competency of Physics teachers in West Sumatra Province is independent on their employment status since their motivation can be controlled by themselves.

Other Factors That Affect The Competency Of Physics Teachers

Respondents also suggested several factors that affect the competency of Physics teachers, including digital literacy, support from school management, expertise in utilizing technological advances, and encouragement from the school environment and principal to foster self-development. However, a larger proportion of respondents highlighted that digital literacy skills and support from school management were particularly influential factors.

Digital literacy goes beyond basic computer skills; it encompasses the ability to leverage various digital tools and platforms to enhance teaching, manage learning resources, and engage students more effectively (Anthonysamy, Koo & Hew, 2020). To be considered competent, teachers must possess exceptional abilities and expertise in using and operating digital technology in line with the evolving landscape of education (Ahyani, et al., 2024). This digital literacy is crucial in enhancing a teacher's performance, particularly for Physics teachers, as it enables them to adapt to modern teaching methods and effectively engage students (Putra, et al., 2023). The ability to manage information, teach online, develop exciting learning materials, and maintain digital security are some of the crucial aspects that must be mastered by teachers. For Physics teachers, digital

literacy is especially crucial as it enables them to incorporate technology into lessons, design interactive learning experiences, access and analyse digital content, and teach students how to use digital tools for scientific exploration. This certainly shows the extent to which the teacher has competence in both skills and understanding the development of technology that is in line with the learning process.

Support from school management affects the competency of a Physics teacher as it has an impact on how the environment can support the ability and competence of a teacher, especially a Physics teacher. This can be seen from how the principal encourages, supports and provides space for teachers to develop their abilities and skills to become competent teachers. Therefore, principals should be skilled in guiding teachers with lesson planning and providing effective supervision to enhance their teaching and professional development (Amelia, et al., 2022). The role of school management and the environment are also essential in fostering a supportive learning atmosphere (Maba, 2022). Effective planning, organization, direction, and control are key for school management to help integrate character values and support the academic and personal development of students.

CONCLUSION

Factors affecting the competency of Physics teachers in West Sumatra Province have been successfully determined in this research. The findings indicated that the main factors that significantly influence the competency of a Physics teacher in West Sumatra Province were self-concept and communication skills, according to respondents' perspectives. Respondents also suggested that digital literacy and school management support could influence Physics teachers' competency in West Sumatra. However, this research only investigates the possible factors that affect the competency of a Physics teacher in West Sumatra Province. Hence, further study should be performed to develop an instrument for the Physics teacher competency model in West Sumatra Province and Indonesia

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