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## Contents

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# The influence of teacher certification towards the pedagogic and professional competences of a physics teacher

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This study examines the influence of certification and teacher attitude on the pedagogical and professional competences of physics teachers. The study was conducted at the Center for Teacher Certification in Gorontalo. The 60 teachers involved in the study were selected using a multistage sampling technique. Three main outcomes emerged from the study: physics certified teachers showed higher pedagogic and professional competences than uncertified teachers The teacher certification program divides teachers into two groups; certified and not yet certified, of which the former are entitled to a professional allowance

Keywords: certification, pedagogic and professional competences, and teacher attitudes

Teacher education and training in Indonesia is currently altering toward improving the quality of education and boosting student performance. Effective teacher education is a cornerstone of a country's development. The speed and effectiveness of student learning is influenced by a number of factors, many of which are under teacher control (Avis, Fisher & Thompson, 2010).

The productivity of teachers varies considerably (Dobbie, 2011), and teacher certification is assumed fundamental to improving teacher quality and professionalism. However, effective teaching requires certain necessary competencies; that is, the ability to teach to a satisfactory standard (Brown, Patrick, Tate, & Wright, 1994).

Indonesia's Education Act of 2005 mentions four teacher competencies; pedagogical competence, personal competence, social competence, and professional competence, which must be mastered by every certified teacher, if they are to be considered professional. These competencies are identified and monitored through a teacher certification program, initiated in 2006 and due for completion in 2015. The certification program encompasses professional education, portfolio assessment, and education and teacher professional training.

A professional teacher must plan lessons, assess students, monitor student progress, supervise and assess the learners (Ministry of Education, 2009). A professional teacher is also required to change the attitudes, beliefs and behavior of the students.

The largest obstacle to positive teacher attitudes, which might in turn influence the pedagogical and profession competencies of teachers, is cultural attitude (the sets of beliefs and emotions that underlie social attitudes). Culture is not easily modified (Padayachee, 2012). The teacher certification program in Indonesia faces several challenges that might limit its effectiveness in improving teacher education. Craig (1998) suggests that fundamental gains in teacher quality and the significance of teaching can be attained by introducing: 1. support systems, 2. continuing professional development at an elementary level, and 3. continuing professional development at the advanced level. Inspired by this idea, I examined whether the teacher certification program in Indonesia affects the pedagogical and professional competencies of teachers in Gorontalo Province.

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## *Problem statement*

The problem should indicate the focus of the study and must be sufficiently significant (Gay, Mills, & Airasian, 2009). A problem can be defined as any unsatisfactory or unsettling item (Fraenkel & Wallen, 2007), and can be formulated as a statement, a hypothesis and/or a question(s). In this research, the problem is presented in question form as below:

- Is there any difference in the pedagogical and professional competencies between certified physics teachers and those not yet certified?
- Is there any relationship between a teacher's certification status and the attitude towards a teacher's pedagogic and professional competencies among physics teachers?
- Among teachers expressing positive attitudes towards their profession, is there any difference in the pedagogic and professional competencies of the certified physics teachers and those not yet certified?
- Among teachers expressing negative attitudes towards their profession, is there any difference in the pedagogic and professional competencies between the certified teachers and those not yet certified?

## *Theoretical review*

*Pedagogical and professional competencies:* A competence is an underlying characteristic of an individual that affects his/her ability to achieve the established objectives (Spencer, 1993). The competencies among individuals vary considerably. Elliot and Dweck (2005), reporting on the Self-Determination theory (SDT), suggest that competence is an inherent psychological human need. The SDT posits that human achievement is based on three innate needs; namely, competence, autonomy and relatedness. Pedagogical and professional competencies are the most decisive factors for learning processes. Therefore, the pedagogical and professional competences of teachers, especially those related to teaching methods and techniques, require strong support.

## *Pedagogical competence*

According to Danim (2010), a teacher who has good pedagogical management competences will: (1) create a supportive learning environment, (2) encourage reflective thinking and action,

(3) improve the relevance of new learning, (4) facilitate mutual learning, (5) make connections to prior learning and experience, (6) provide ample opportunity for learning, and (7) investigate the relationship between learning and teaching

According to Bucat (2004), pedagogical knowledge refers to how an individual understands the learning process. Although the sole emphasis is on learning, the learning process will be successful if properly prepared through lesson planning. Thus, pedagogic skills cover the ability to develop the curriculum, to plan and implement lessons, and to evaluate student progress. From the above discussion, pedagogical competence can be summarized as the ability of teachers to: (1) develop curriculum, (2) facilitate learning, (3) carry out the study, and (4) assessing the learning outcomes.

Professional teachers are able to learn and master the material guides for students, and thereby meet the standards of competence stipulated in the National Education Standards, namely: (1) controlling the content and methodology of subjects taught, (2) mastering the subjects of teaching materials in the primary school curriculum, (3) developing curriculum materials and facilitating creative and innovative learning, (4) mastering the basic ingredients of the extracurricular activities that support overall educational achievement, and (5) assessing and implementing action research (Jalal et al., 2010). Therefore, professional teachers must satisfy a variety of criteria.

Physics is a branch of the Natural Sciences that quantifies the nature and properties of substances and applies them (Wospakrik, 1994). Physics seeks to explain basic natural phenomena. According to Brockhaus et al. (quoted in Druxes, 1995) physics lessons introduce research and experimentation of natural events, explain the measurements obtained, and present mathematical formulae derived from common rules. Alonso and Finn (1980) stress the importance of mathematics in physics.

Science is based on processes or methods, products and scientific attitude. Science processes are the methods used for acquiring knowledge, formally known as the scientific method. The scientific method involves identifying and formulating the problem, proposing hypotheses, designing experiments, analyzing the data and drawing conclusions. The products of science arise from the systematic knowledge (body of knowledge) accumulated by experts performing the scientific method (scientists).

The portfolio assessment of teacher certification has many drawbacks and is potentially problematic. Especially, the data for assessing competence are easily manipulated. Lack of vigilance on the integrity of submitted documents gives the opportunity, among others, to: (1) manipulate documents (2) duplicate the documents as color prints (scan), (3) plagiarize, and (4) employ new services (for instance, manufacture portfolio documents). These problems of portfolio assessment could be ameliorated by following the advice of Rizali (2009); that competence should be based on an initial test portfolio. If the teacher cannot meet a specified level of competence, he should be supplied with appropriate materials that will assist his skill development.

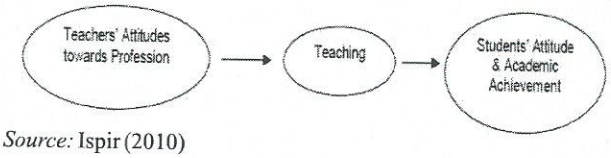
During the assessment of teacher certification, participants whose portfolio fails to attain the minimum graduation score are required to (a) complete their portfolios, or (b) follow the Professional Teacher Education and Training (PLPG) course, followed by an examination. Having consented to the certification body, teachers are eligible to graduate in the teacher certification program. Participants (teachers) who have passed by their portfolios or through the teacher training course will be designated by the university (PLPG) organizers as professional teachers and awarded a certificate.

In Sweden, the certification status of teachers is archived in Statistics Sweden in three categories; certified teachers, non-teaching certified teachers, and teachers without certificates (Anderson & Waldenstrom, 2007). In this certification status, teachers acquire the status of their profession once they have received a certificate from a professional educator. The teaching certificate, administered by a reputable educator, is formal proof of a teachers' professionals' status.

### *Teachers attitudes in the profession*

Positive attitudes can encourage action, while negative attitudes can foster fear rather than trust and confidence (Douglas, 2000). Attitudes are related to individual beliefs and trust. The factors related to individual attitudes are personal values and opinions. Personal characteristics concern the values-espoused norms, while opinions concern environmental response. The three components of attitudes are cognitive, affective, and konasi (Krech & Ballachey, 1962). The cognition components focus on understanding and conceptual interpretation of the presented object. The relationship between teachers 'attitudes and teaching and their impact on students' attitudes and academic achievement. A schematic of this relationship is shown below (Ispir, 2010).

*Figure 1. Relationships between Attitudes and Practices of Teaching*




*Source:* Ispir (2010)

From this figure, student attitudes and achievement are clearly affected by teacher attitude. Attitudes of teachers towards their profession (rejection or acceptance) impact on their teaching. Teachers expressing negative attitudes perform sub-optimally in their professional activities, which reduces the effectiveness of learning. By contrast, teachers displaying a positive attitude continue to promote the profession.

From the above theoretical discussion, the attitude of the teaching profession can be summarized as a tendency for teachers to accept or reject the following teacher roles and experiences: (a) a sense of personal fulfillment, (b) commitment to improve the quality of education, (c) implement tasks in a professional manner, (d) receive income in accordance with work performance, (e) the opportunity to develop a sustainable professionalism, (f) legal protection of task professionalism, and ( g) engagement in professional organizations.

## Method

This research adopts the ex post facto design experiment on a 2 × 2 level. The dependent variables are the pedagogical and professional competences. The treatment variable is the in-service teacher certification status (certified or not certified), while the moderator variables on the teaching profession include positive and negative attitude. The target population for this study was physics teachers employed in First Middle School education. A sample of 60 teachers was drawn from a teacher population of up to 505 (SMP / MTs) in Gorontalo province, 2011, using a multistage sampling technique.

## Results and discussion

Certified physics teachers display different pedagogic and professional competence from teachers who are not yet certified.

The certified teachers seeking education and exercise teacher professionalism will obtain direct enhancement of their pedagogic and professional competence. this situation is very different from that of teachers not yet certified.

Effect of interaction between hypothesis testing and certification status on attitudes towards professional competence and the professional competence of physics teachers

The F value of this test is 40.500, which greatly exceeds F = 7.08 at $\alpha = 0.01$. Thus, the null hypothesis is rejected, and we conclude that the certification status and attitudes towards the profession affect the pedagogical and professional competence of physics teachers.

In addition to certification status, attitude plays a large role in pedagogical and professional competence. A positive attitude to the profession is related to higher levels of both competencies. A teacher who is innately competent but negative toward the profession may demonstrate poor competence in the classroom.

Testing Hypothesis; that Pedagogic and Professional Competence of Physics Teachers Expressing a Positive Attitude to their Profession Does Not Depend on Certification

The Q value, evaluated is 8.540, which exceed the Q value at the 1% significance level (Q = 5.25 at $\alpha$ = 0.01). Again, the null hypothesis is rejected, and we conclude that, among teachers expressing a positive attitude to their profession, certified teachers display higher pedagogical and professional competence than those not yet certified. The average pedagogical and professional competence of positive-attitude certified physics teachers is 288.80, versus 260.43 for the non-certified group.

Although certification improves the competence of teachers expressing positive attitude to their profession, a positive attitude certainly enhances the professional and pedagogical competence of certified teachers. In addition to having access to on-going training resources, these teachers are inherently motivated to provide the best learning experience.

By contrast, non-certified teachers with a positive attitude cannot engage with the activities that would further develop their teacher competence. Thus the pedagogical and professional competence of certified physics teachers is higher than that of non-certified teachers.

*Pedagogic Competence Hypothesis Testing:* The Professional Competence of Physics Teachers Expressing a Negative Attitude Toward their Profession is Not Affected by Certification

The Q value of this test is 4.180, which exceeds Q = 4.080 at $\alpha$ = 0.05. Hence the null hypothesis is rejected, and we conclude that, among physics teachers expressing a negative attitude to their profession, the pedagogical and professional competence of certified teachers is lower than that of non-certified teachers. The average pedagogical and professional competence of certified and non-certified physics teachers in this group is 232.70 and 242.17, respectively.

*Pedagogic Competence Hypothesis:* Differences Between Certified and Non-Certified Physics Teachers

In this test, the F value (4.255) exceeds the F value at the five percent significance level (4.000 at $\alpha = 0.05$) so the null hypothesis is again rejected. We conclude that pedagogical competence is higher among certified physics teachers than non-certified teachers. The average pedagogical competence of certified physics teachers is 135.80, versus 134.00 for the non-certified group.

*Hypothesis Testing:* Effect of interaction and certification status on professional attitudes towards physics teacher pedagogic competence

In this test, the F value is 54.994, much higher than F at $\alpha = 0.01$ (7.08). Thus, the null hypothesis is rejected and we conclude that interaction occurs between certification status and the attitude of the profession toward the pedagogical competence of physics teachers deemed "acceptable".

The fifth hypothesis tested whether the pedagogical competence of certified teachers is higher than that of non-certified teachers. Trained teachers displaying a positive attitude to the teaching profession have not only honed their competencies through certification activities but are also committed to improving the quality of education. The teacher role also imposes responsibility for the professional execution of tasks and accepting the outcomes of work performance. Thus, an interaction arises between teacher certification status and attitudes towards the teaching profession among physics teachers. Consequently, the status of certification impacts on the professional attitude toward the pedagogical competence of physics teachers.

*Pedagogic Competence Hypothesis;* the Competence of Physics Teachers Expressing a Positive Attitude Towards their Profession Does Not Depend on Certification Status.

The Q value of this test is 9.478, which exceeds Q = 5.25 at $\alpha$ = 0.01. Again, the null hypothesis is rejected, and we accept that, among physics teachers expressing a positive attitude towards their profession, certification improves the pedagogical competence. The pedagogical competence averaged 150.50 among certified physics teachers, versus 136.67 in the non-certified group.

*Pedagogic Competence Hypothesis:* that the Competence of Physics Teachers Expressing a Negative Attitude Toward their Profession Does Not Depend on Certification Status.

In this test, the Q value is 5.353, slightly exceeding the Q value at the 1% significance level (5.250). Thus, the null hypothesis is rejected, and we conclude that among teachers expressing a negative attitude to their profession, the pedagogical competence of a certified physics teachers not deemed acceptable differs from that of a non-certified teacher. The average pedagogical competence of certified physics teacher in this group is 120.77, while that of the non-certified teachers is 132.50. Thus pedagogical competence is lower among certified physics teachers than in non-certified teachers with a negative attitude toward their profession.

Unlike the teachers expressing a positive attitude to their profession, negatively-oriented teachers merely fulfill the demands of a task (abort obligation), without displaying the full extent of their pedagogical competence.

Hypothesis Testing; that Professional Competence of Physics Teachers Does Not Depend on Certification

Here, the F-value (21.962) largely exceeds F at the 1% significance level (7.080 at $\alpha$ = 0.01), so the null hypothesis is rejected, and we conclude that the professional competence of non-certified physics teachers of physics is higher that of certified teachers. The average professional competence of certified physics teachers is 123.77, versus 120.30 for the non-certified group.

Professional competence indicates the maximum capacity of teachers to impart their mastery of the material, structure, concepts and mindsets of physics. Certified teachers have undertaken refresher training and education that helps them acquire physics-related skills and teaching materials. Among the supporting activities undertaken by physics teachers are (1) preparing teaching materials (2) creating instructional media, (3) preparing scientific papers, (4) assessing activities that are difficult to understand and teach and (5) controlling materials during peer teaching. Access to refresher materials ensures that qualified teachers display greater professional competence than their non-certified counterparts.

*Hypothesis Testing:* Effect of Interaction Between Certification Status and Attitudes Toward the Profession on the Professional Competence of Physics Teachers

The F value of this test is 23.266. Given that $F = 7.08$ at $\alpha = 0.01$, the null hypothesis is rejected and we accept that an interaction occurs between certification status and the attitude of the profession toward the professional competence of physics teachers deemed "acceptable".

The professional competence of physics teachers is therefore affected not merely by certification status, but also by the attitude factor in the teaching profession. The perception of the teaching profession can determine competency, not least because attitudes toward the profession may increase teachers' commitment to improving the quality of education. The teacher who delivers quality education possesses strong ability in the subjects taught. Thus, teacher certification status is linked to attitudes towards the teaching profession, and the combined factors impact upon the professional competence of physics teachers.

*Hypothesis Testing:* that the Professional Competence Among Teachers Expressing a Positive Attitude Toward their Profession Does Not Depend on Certification

The Q value of this test is 7.610, which exceeds the Q value of 5.25 at $\alpha = 0.01$. Again rejecting the null hypothesis, we conclude that, among teachers expressing a positive attitude toward the profession, certification improves the professional competence. The average professional competence of certified physics teachers is 135.67, while that of the non-certified group is 122.97.

Thus, the professional competence of a certified physics teacher expressing a positive attitude exceeds that of a non-certified teacher with the same sentiments, because the certified teachers have been awarded a degree or diploma.

Non-certified physics teachers have not gained the experience that benefits established teachers.

*Hypothesis Testing:* that the Professional Competence Among Teachers Expressing a Negative Attitude Toward their Profession Does Not Depend on Certification

In this test, the Q value (3.15) lies within the 5% significance level ($Q = 4.08$ at $\alpha = 0.05$). Therefore, we accept the null hypothesis, and conclude that a negative attitude to the profession exerts greater impact on professional competence than qualification.

If a teacher desires to improve his professional competence, he must improve his knowledge of all physics, since the various physics fields are unified. This improvement requires a long-term commitment. Thus, the professional competence of non-motivated qualified teachers is lower than that of non-certified teachers.

## Conclusion

- The pedagogical and professional competence of certified physics teachers is higher than that of non-certified teachers.
- Significant interaction exists between certification status and the attitude of the profession toward the pedagogical and professional competence of physics teachers.
- Among teachers expressing a positive attitude to their profession, qualification enhances pedagogical and professional competency.
- Non-certified teachers expressing a negative attitude to their profession display higher pedagogical and professional competency than their trained counterparts.
- Qualification advances the pedagogical competence of physics teachers.
- Significant interaction exists between certification status and the attitude of the profession toward the pedagogical competence of physics teachers.
- The pedagogical competence of teachers expressing a positive attitude to the profession is enhanced by qualification.
- Non-qualified teachers expressing a negative attitude to their profession display higher pedagogical competence than trained teachers.
- Qualification improves the professional competence of physics teachers.
- Significant interaction exists between certification status and the attitude of the profession toward the professional competence of physics teachers.
- The professional competence of teachers expressing a positive attitude to their profession is improved by qualification.

## Implications of the study

The research hypothesis testing undertaken in this study indicates that the pedagogical and professional competence of physics teachers is enhanced by two factors; formal qualifications and the attitude toward the physics teaching profession.

### *Improving teacher certification status*

Intervention to increase participation in teacher certification programs is rendered difficult by the various mechanisms used to accrue participants. To remedy this situation, I propose that: (a) ongoing refresher courses be available to trained teachers, and (b) educational activities and focused training be provided.

Container activities for school-level teachers are focused on brainstorming and preparing learning problems that directly improve the quality of learning. Focused activities may be conducted by school activities or external events. Teachers select the subsequent activities; however, not all seminars, workshops, and training are accessible to teachers. The increasing emphasis on gaining qualifications that confer a certificate/charter should be balanced against acquiring competence as a teacher.

In addition to participation in competence-enhancing activities, teachers are also expected to train each other on the subsequent activities.

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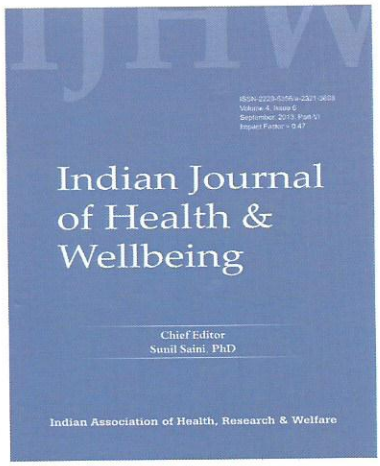


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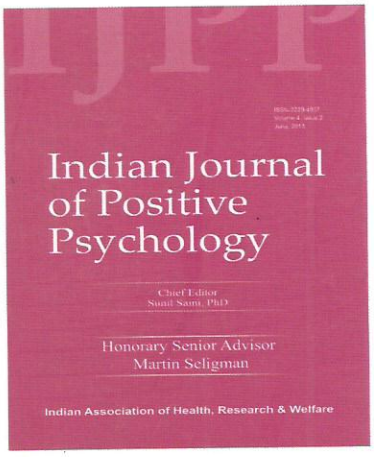


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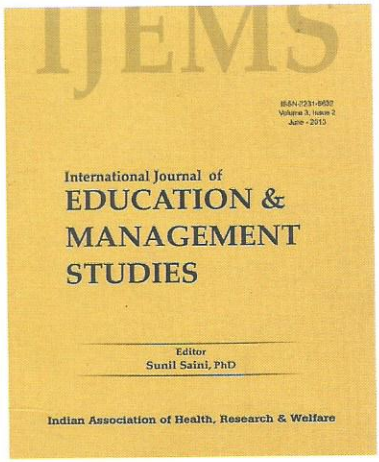


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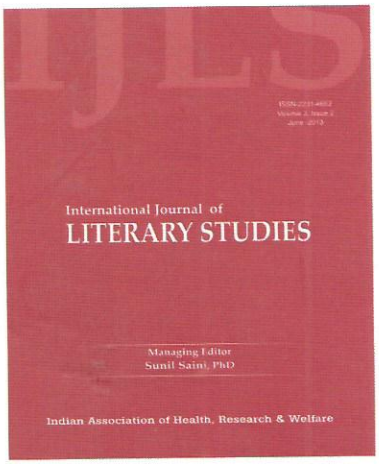


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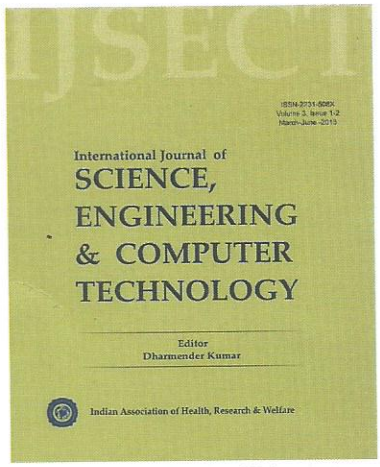


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