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Measuring the Classification of Digital Natives use Digital Natives Assessment Scale: The Implementation on Pre-Service Physics Teachers in Banten-Indonesia and Its Implications

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Abstract

Education in the digital era had shifted conventional learning methods to digital technology-based learning. Likewise with students have to be faced by pre-service physics teachers who have entered the generation of digital natives. However, is it true that the concept of digital natives exists? Moreover, whether pre-service physics teachers belong to that generation? Therefore, the objective of this study was to prove the construct validity of the Digital Natives Assessment Scale using data from pre-service physics teachers in Banten Province, Indonesia. And follow-up analysis is used to find the relationship between digital natives' status and pre-service physics teacher technology mastery. This study used a quantitative approach with the correlational method. The type of correlation research chosen was Confirmatory Factor Analysis (CFA). The instrument used was a Digital Natives Assessment Scale (DNAS) questionnaire consisting of 21 items and four factors, measured using a 7-point scale. The results showed that this study could not prove the 4-factor DNAS model for pre-service teacher participants in Banten Province based on the results of the CFA. And there was no relationship between the status of digital natives and the level of technology mastery of pre-service teachers based on Pearson correlation analysis. So it can be concluded that using a sample of student-teacher candidates in Indonesia, the 4-factor DNAS cannot be proven construct validity. However, this decision is not final but should be tested on a larger scale to show DNAS matches.

Keywords: Banten province, confirmatory factor analysis, digital natives, mastery of technology, pre-service teacher

INTRODUCTION

Increasingly digital world makes technology skills become the primary competence, not only for professionals (Bakri et al. 2021). Education in the digital era has shifted conventional learning to be more modern and practical by using technology. Many students' attitudes and behavior in everyday life are influenced by digital technology. Therefore, this situation becomes a challenge for teacher (Oktasari et al. 2020) and also pre-service teachers who will later handle future education. They are required to teach the digital native generation (Nazirwan 2019). Prospective teacher candidates must have special skills to deal with fast-paced cultural changes (Nasution 2018). From this problem came the statement, "if students belong to the digital native generation, then the pre-service teacher should also be a digitally native generation". Logically, this statement is true. To handle the digital native generation, the pre-service teacher must be more than that.

Teachers must address this generation in learning and keep abreast of technological developments. The term digital native emerged because students operate in a technology-rich environment that has caused changes in brain structure, making young people think and process information in a fundamentally different way compared to older people (Teo 2013). However, the use of the term digital native still causes much controversy. Among them are related to who are called digital natives? What are the characteristics? Age? Or related to mastery of digital technology?. Some researchers classify people born after 1980 as digital natives, while those born before were digital immigrants (Guo, Dobson & Petrina 2008; Riordan 2014). However, Prensky (2001), as the originator of the term digital native, stated that although digital natives are determined by age, not all young people are digital natives. More than just age, digital natives share common attributes and experiences regarding how they interact with technology, information, each other, other people, and institutions (Prensky 2001). In conclusion, age is not the most appropriate indicator of digital natives. They are used to receiving information quickly, like parallel processing, multitask, and prefer graphics over text. They also prefer random access and work best when connected to a network. They thrive on instant gratification and reward and prefer games to 'serious work' (Prensky 2001).

The problem with digital natives continues for student-teacher candidates as prospective educators in a more advanced digital era. Several studies have shown that pre-service teachers are "original users" in using digital technology in the classroom (Pierson & Cozart 2005; Lei 2009; Wang 2019). The innate skills of the digital native generation contribute to pre-service teacher support for emerging technologies and readiness to incorporate innovative technologies into their teaching (Fluck & Dowden 2013; Thomas & O'Bannon 2015). Several previous studies showing that pre-service teachers are digital natives are only limited from a theoretical point of view, meaning that there is no actual proof. Then an issue arises related to this concept, whether the digital native is an identity that is only attached to people born after 1980 or can indeed be formed by itself based on the experience of interacting with an environment based on digital technology. To prove whether digital natives are real or just myths, Teo (2013) developed an instrument to measure digital natives with the Digital Natives Assessment Scale (DNAS). This instrument is a self-assessment with a Likert scale of 7 scales, consisting of 21 with four factors: (1) grow up with technology, (2) be comfortable with multitasking, (3) rely on graphics for communication, and (4) thrive on instant gratifications and rewards. Several research results show that the 4-factor DNAS model is suitable for measuring the digital natives of prospective teacher students in Singapore, China, and Turkey (Teo 2013; Chen, Teo & Zhou 2016; Huang, Teo & He 2019). However, some studies show that the 4-factor DNAS model is not suitable for application to student-teacher candidates in America (Wilson, Hall & Mulder 2020). We examine two samples in more depth, namely samples from two superpower countries, namely China and America, but produce different construct validity. The two samples are considered as samples that have experienced rapid development in digital technology. Due to the conflicting results of this study, it was felt that the 4-factor DNAS model testing was carried out on different participants, mainly applied to samples in developing countries such as Indonesia. The environment is very different from the two superpowers. So this study wants to prove the construct validity of DNAS to answer issues related to whether the digital native is an inherent identity or can be obtained through real experience interacting with digital technology. Because if you look at the DNAS factor, it has raised the issue of knowledge, but only limited to the use of social media. So there is a contradiction with the term digital native. When interpreted in general, it means flexibility in using various digital technologies. Therefore, in this study, further tests were carried out by linking the results of DNAS with the mastery of technology by students based on the achievements of the learning media course.

METHODS

This study uses a quantitative approach with a correlational method (Fraenkel, Wallen, & Hyun 2012). The type of correlation research chosen is Confirmatory Factor Analysis (CFA). This analysis is used to describe how well the observed indicators (items in the survey) measure the unobserved (latent) constructs of an instrument. The instrument used is a Digital Natives Assessment Scale (DNAS) questionnaire (Teo 2013) to determine the "Digital Native" of pre-service physics teacher students. The DNAS consists of 21 items and four factors, measured using a 7-point scale, ranging from 7 for

"strongly agree" and 1 for "strongly disagree." The scores of these items can be summed collectively (ranging from 21 to 147) to represent the individual level of perception of the four factors in the DNAS. Higher scores indicate closer to being a digital native. Teo (2013) chose the 4-factor DNAS model because it is the most suitable instrument for measuring digital native compared to the other two alternative models (Teo 2013). The DNAS instrument was then first translated into Indonesian before being distributed to participants. The 4-factor DNAS model was estimated using Maximum Likelihood Estimation (MLE), where all analyzes were performed on the variance-covariance matrix. In addition, a correlation analysis was also carried out between digital nativity and the mastery of technology for pre-service teachers.

This study involved more than 150 pre-service physics teacher students at one of the universities in Banten Province, Indonesia. However, only $N = 127$ students completed the entire DNAS questionnaire. Of all the students involved, 80% were female and 20% male. Participants represent all districts in Banten Province. For the CFA test with Maximum Likelihood Estimation (MLE), the number of participants as many as 127 has been fulfilled; namely, at least one observed variable/item is represented by 5 participants (Wijanto 2008). The number of DNAS items used was 21, so the minimum number of participants was $21 \times 5 = 105$.

Before filling out a questionnaire, all participants were informed about the purpose of the study. Also, participants were explained that they had the right to withdraw their answers. From the study at any time, during or after this research. All participants had volunteered for the study, and the researchers offered no in-kind or monetary rewards. On average, participants took about 12 minutes to fill out the questionnaire.

In data analysis, LISREL 8.80 is used as computer software for Confirmatory Factor Analysis (CFA). Before CFA, the data were tested whether they were normally distributed in multivariate or not. This multivariate normality test is a prerequisite for the CFA test. Multivariate average distribution data is seen from the value of skewness and kurtosis, with skewness value < 2 and kurtosis value < 7 (Curran, West & Finch 1996). After the prerequisite test is met, then proceed with the CFA test. The CFA results obtained are then matched with several parameter values (Brown & Cudeck 1993; Kline 2005; Wijanto 2008; Kasanah 2015), as shown in TABLE 1.

TABLE 1. Comparison of the measures of Goodness of Fit

Size of Goodness of Fit	Acceptable match rate
Chi-Square (χ^2)	The smaller the value the better, or $p > 0.05$
Root Mean Square Approximation (RMSEA)	$RMSEA \leq 0.05$ it means <i>close fit</i> $0.05 < RMSEA \leq 0.08$ it means <i>good fit</i>
Root Mean Square Residual (RMR)	$RMR \leq 0.05$ it means <i>good fit</i>
Standardized RMR (S-RMR)	$S-RMR \leq 0.05$ it means <i>good fit</i>
Comparative Fit Index (CFI)	$CFI \geq 0.9$ it means <i>good fit</i> $0.8 \leq CFI < 0.9$ it means <i>marginal fit</i>
Godness of Fit Index (GFI)	$GFI \geq 0.9$ it means <i>good fit</i> $0.8 \leq GFI < 0.9$ it means <i>marginal fit</i>
Incremental Fit Index (IFI)	$IFI \geq 0.9$ it means <i>good fit</i> $0.8 \leq IFI < 0.9$ it means <i>marginal fit</i>

The interpretation of the level of fit, between the data and the model will be compared with how many TABLE 1 are met. The following analysis is the correlation test between DNAS results and the value of multimedia learning courses. The writer chose this course because it reveals students' level of mastery in applying the latest technology, especially in learning. The correlation test used is the Pearson correlation with the interpretation of the value between $-1 < r < 1$. The more significant and more positive the value of r , the closer the relationship between the variables (Benesty et al. 2009).

RESULTS AND DISCUSSION

The first objective of this study was to prove the construct validity of the 4-factor Digital Natives Assessment Scale (DNAS) model. According to Teo (2013), these four factors are 1) grow up with technology; 2) being comfortable with multitasking; 3) being reliant on graphics for communication; and 4) thriving on instant gratifications and rewards. The data used is derived from a survey on pre-service teacher participants in Banten Province, Indonesia. The processed data has met the prerequisite

test, namely multivariate normality using the LISREL 8.80 software. Multivariate normally distributed data is seen based on skewness and kurtosis (Curran, West, & Finch 1996), with a skewness value of 1.378 less than 2 and a kurtosis value of 6.522 less than 7. Since the prerequisite test has been met, proceed with Confirmatory Factor Analysis (CFA). Based on the results of the CFA obtained several parameter values as shown in TABLE 2.

TABLE 2. The results of the comparison of the value of Goodness of Fit

Size of Godness of Fit	Value	Interpretation
Chi-Square (χ^2)	$\chi^2 = 259.49$ and $p = 0.0017$	Bad fit
Root Mean Square Approximation (RMSEA)	0.058	Good fit
Root Mean Square Residual (RMR)	0.03	Good fit
Standardized RMR (S-RMR)	0.086	Bad fit
Comparative Fit Index (CFI)	0.88	Marginal fit
Godness of Fit Index (GFI)	0.84	Marginal fit
Incremental Fit Index (IFI)	0.88	Marginal fit

TABLE 2. shows that most of the parameters are not met, or in other words, it is called marginal fit. Why is the tested model not fit? This question has been answered by looking at the previous parameters, but the path diagram can explain a more in-depth reason, as shown in FIGURE 1.

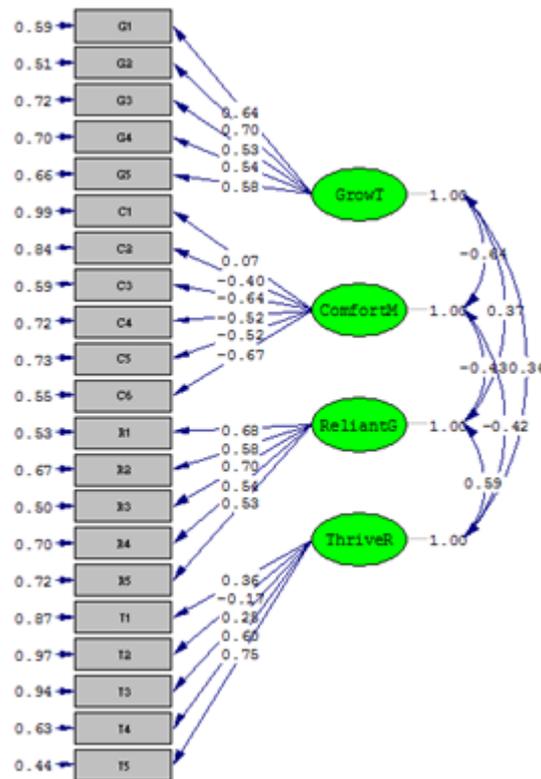


FIGURE 1. Path diagram of CFA results from the DNAS instrument

In FIGURE 1, it can be seen the "loading factor" between the construct and the item (an example of the value listed on the connecting line between GrowT and G1). Loading factor is the correlation between indicators (in this study represented directly by 21 items because there are no indicators) and latent constructs (symbolized by GrowT, ComfortM, ReliantG, and ThriveR). Items with a high loading factor have a higher contribution to explain the latent construct. Valid/suitable criteria in CFA if loading factor > 0.50 ($N=127$) (Hair et al. 2010). Many items have a loading factor < 0.50 , as shown in FIGURE 1.

In contrast, items with a negative loading factor mean that they have the opposite contribution or can be caused by a negative form of a statement. The things that contribute to the latent construct include five C1, C2, C4, C6, and T1. While C3, C5, and T2 are negative statements, the loading factor

should be positive and contribute generously to the construct. The negative statements relate to "I cannot do work using the internet while listening to music (C3)", "I cannot use more than one application on the computer at the same time (C5)" and "I don't expect quick access to information when I need it (T2)".

The five items that did not contribute well in this study caused the 4-factor DNAS model to be unacceptable, in contrast to the research results conducted on pre-service teacher students in Turkey, Singapore, and China (Teo 2013; Chen, Teo & Zhou 2016). However, one study supports our research, namely the research conducted by Wilson, Hall & Mulder (2020). Their research shows that the 4-factor DNAS model is not suitable for measuring "digital natives" in student-teacher candidates in America. Based on the results of the analysis of various literature and research conducted, several things can affect the results of CFA, especially on the loading factor. The first is data variation. The five items with a low loading factor have the lowest data variation values, with a range of 7.1-7.3 (data variation is obtained from the distribution of the average score on the item with the standard deviation). At the same time, other things have a variation of > 11 . It is more difficult to use items with low data variation as an item or a measuring tool for a construct. In other words, the difference in construct scores is more difficult to explain by items with almost the same value (low data variation). Gender aspects most likely influence slight data variation (Guntara, Hafid & Sari 2021). Judging from the proportion of gender, this study was dominated by women, namely 80% of the total participants. This proportion is almost the same as Wilson, Hall and Mulder (2020), as many as 76% women. This difference in gender proportions also causes the 4-factor DNAS model not to be accepted by student-teacher candidates in America (Wilson, Hall & Mulder 2020). In contrast to the research conducted by Teo (2013), the proportion of women and men is almost the same. So it can be concluded that based on the results of the data obtained, this DNAS is not consistent when applied to different populations (Messick 1998). A good instrument should be used everywhere, the results will be compatible.

Age, socio-economic conditions, and disciplines (Bennet & Bennet 2008). There is no problem from the aspect of age because the participants' average age is around $M=20.8$. This means that it is following previous studies, although digital natives are by age (Tran et al. 2020). From the aspect of scientific discipline, it is almost the same, namely pre-service teachers of the Mathematics and Natural Sciences clump so that it is not too influential. However, what might affect it is from the socio-economic aspect. If we refer to the statistical data released by BPS Banten (2021), on July 15, 2021, when the survey was carried out around March 2021, it was recorded that the population with low economic conditions was 867.23 thousand people, or 6.66%. They collect on the comfortable multitasking construct if it is associated with statements or items with a low loading factor. The construct wants to measure a person in terms of doing many jobs simultaneously. Participants' answers had an average of $M=2.3$ to $M=3.2$ on these items. This is due to poor economic conditions, causing student teacher candidates to focus on one job.

Another thing is due to environmental conditions that do not allow multitasking. For example, the item "I can surf the internet and do other activities comfortably" has the lowest average ($M=2,3$). Participants do not have internet access due to not having a quota. Low connectivity could also be caused because it is still challenging to get excellent and stable connectivity in some places in Banten. From the analysis and discussion results, this study could not prove the 4-factor DNAS model. This is also related to DNAS still not measuring pre-service teacher students' "digital natives" in Banten Province. It is necessary to conduct a more in-depth study of the term "digital natives", mainly as it is applied to pre-service teacher participants throughout Indonesia. So later, we can prove that these "digital natives" are not just a myth (Bennett & Maton 2010; Yong, Gates, & Harrison 2010; Kirschner & De Bruyckere 2017).

The purpose of the second study is to show whether there is a relationship between the "digital nativity" status of a pre-service teacher and mastery of technology, especially those related to education. We assume that the DNAS can measure digital natives. The Pearson correlation analysis using IBM SPSS Statistics 24 showed a correlation value of 0.002 with a significance of $0.987 > 0.05$. This means that by using a significance of 0.05, it can be concluded that there is no relationship between the status of digital natives and the level of technology mastery of pre-service teacher students. From the results of the researchers' analysis of the items on DNAS, most of them only show how a person interacts with social media or communication technology throughout his life. Therefore, it is difficult

to determine the relationship with the level of students' technological mastery. Because it could be students who rarely use social media, but ability of technology is even higher. Digital natives, when juxtaposed with terms in language acquisition, for example, English natives, are people who were born into English-speaking families and used that language every day. Likewise with digital natives, meaning that from birth to adulthood in everyday life, they are accustomed to the digital world, both in the form of technology and information.

The technology used in learning media courses is social media, such as Instagram, WhatsApp, and Facebook, because it is adapted to the technology familiar to the millennial generation (Thang et al. 2015). However, some pre-service teachers are only good at using social media for things that are not essential, not related to education. This means that social media is only used for entertainment. So actually, the measurement of digital natives is less relevant if applied to pre-service teacher students because pre-service teachers are required to master technology. Whether social media or not, pre-service teachers should implement it in real terms in teaching activities. Indeed, many pre-service teachers are still not ready to use technology or are "technological stutterers". University must train pre-service teachers a lot on integrating technology into teaching materials. Among them as designing a two lens system experiment media for pre-service physics teachers (Saprudin et al. 2018) or STEM worksheets based on local wisdom (Utami et al. 2020). However, using DNAS is not able to measure this ability. So it can be concluded that regardless of whether the students are digital natives or not, students' responses should be measured by the Technology Integration Assessment Rubric (Harris, Grandgenett & Hofer 2010). Students' initial abilities or perceptions of themselves will be seen more clearly in mastering technology with this instrument. This indication of mastery is significant because in this digital era, pre-service teacher students must be ready and able to use various kinds of technology in learning (Minott-Bent 2020). However, suppose pre-service teachers apply this DNAS to school students. In that case, students today tend to use multiple media sources at the same time. For example, they text while in college or watch TV while doing homework (Mercimek et al. 2020). on the other hand, it may be helpful to prepare more effective learning because it is adapted to the actual conditions of the students. So if it is concluded that this DNAS has not measured the digital native construct essentially, exceptionally if it is returned to the general definition. Therefore, when used for different samples, it will cause other construct validity. A more in-depth study of the preparation of the DNAS construct is needed so that it does not tend only to want to reveal the habit of using social media but is more directed to its application to life, especially education.

CONCLUSION

Based on the analysis and discussion results, it can be concluded that this study could not prove the construct validity of the 4-factor DNAS model for pre-service teacher participants in Banten Province. They were supported by CFA results which show some parameters that do not fit. While further explanation, analyzed using a path diagram which shows five items have a small loading factor. Thus, the 4-factor DNAS instrument does not fit based on the CFA and indicates that the instrument is inconsistent in measuring digital native. The implication is that if the participants have different characteristics, it will cause different results. The second analysis of this study shows no relationship between the status of digital natives and the level of technical mastery of pre-service teacher students. Lack of connection because DNAS does not explore information about student status based on ability in terms of knowledge of applicable technology such as in education, but only analyzes data related to the use of social media in everyday life. The implication is that to find out the level of technical mastery. Pre-service teacher students do not need to know whether the student belongs to the digital native generation. However, this decision is not final but should be tested on a larger scale to show DNAS matches.

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