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Instrument Development to Measure Teacher Attitudes toward Inclusive Education in Learning Technology Dimension

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Abstract
The current study develops an instrument that measures a person's attitude towards learning technology in inclusive education. The results are expected to be a way to establish acceptable learning environment for all students. This instrument was developed with four steps in the research and development method: information collection, planning, initial product development, and validation & revision. The current instruments contained 21 items, which were grouped into three components. The determination of the terms of the three components will be carried out in further research. The findings shows that the instrument is proven to be reliable and valid. This instrument shows that one of the ways to create an acceptable learning environment for all students is to establish a class with a universal design so that all students have physical access to all materials and activities without the child experiencing difficulties. Technology plays an essential role for education following the sustainable development goals (SDGs) to answer the demands of world leadership in overcoming inequality.
Keywords: *inclusive education dimension, learning environment, learning technology, attitude, sustainable development goals.*

Abstrak
Penelitian saat ini mengembangkan instrumen yang mengukur sikap seseorang terhadap teknologi pembelajaran dalam pendidikan inklusif. Hasilnya diharapkan menjadi cara untuk menciptakan lingkungan belajar yang dapat diterima oleh semua siswa. Instrumen ini dikembangkan dengan empat langkah metode penelitian dan pengembangan: pengumpulan informasi, perencanaan, pengembangan produk awal, dan validasi & revisi. Instrumen yang ada saat ini berisi 21 item yang dikelompokkan menjadi tiga komponen. Penentuan syarat ketiga komponen tersebut akan dilakukan pada penelitian selanjutnya. Temuannya menunjukkan bahwa instrumen terbukti reliabel dan valid. Instrumen ini menunjukkan bahwa salah satu cara untuk menciptakan lingkungan belajar yang dapat diterima oleh semua siswa adalah dengan mendirikan kelas dengan desain universal sehingga semua siswa memiliki akses fisik terhadap semua materi dan aktivitas tanpa anak mengalami kesulitan. Teknologi berperan penting bagi pendidikan sesuai dengan tujuan pembangunan berkelanjutan (SDGs) untuk menjawab tuntutan kepemimpinan dunia dalam mengatasi kesenjangan.
Kata kunci: dimensi pendidikan inklusif, lingkungan belajar, teknologi pembelajaran, sikap, tujuan pembangunan berkelanjutan

INTRODUCTION

Inclusive education settings have a purpose to expect a learning environment acceptable to all students. Inclusive learning environments pay attention to universal learning design, flexible curricula, competence and positive attitudes of teachers, and accessible supporting facilities (Ramadhani, Ediyanto, Sunandar, Nandya, & Atika 2021). Technology also has a vital role in creating a learning environment acceptable to all students. Technology plays a vital role in education in accordance with the sustainable development goals (SDGs) to answer the demands of world leadership in overcoming inequality. The SDGs carry vital goal in assuring all people to have access to high-quality education and promoting lifelong learning opportinities. Global demands require the world of education to adjust technological developments in improving the quality of education constantly. One of the technology's benefit in education is that it can effectively train basic skills to achieve equal educational benefits (Kosakowski 1998).

Concerning inclusive education, three components of attitude, affective, cognitive, and behavior, have tended to be consistent, so that changes in one component of attitude will tend to produce changes related to other components (Hawkins & Mothersbaugh, 2010). As a result, attitudes have characteristics that are relatively consistent with reflected behavior. Therefore, attitude is a broad assessment of psychological tendencies toward a person, object, or situation. The importance of measuring one's attitude towards inclusive education requires a valid instrument, easy to administer, concise, flexible, and reliable (Mahat, 2008). The developed instrument to measure a person's attitude towards inclusive education should follow the following requirements (Cullen, Gregory, & Noto, 2010; Antonak & Livneh, 2000), a) it covers three dimensions of affective, cognitive, and behavior attitudes, b) the instrument is developed in countries that will be used, this is because the subject tends to vary according to each culture, c) the instrument is created within the last ten years to account for educational developments throughout that time, d) the instrument should be usable and valid. Of all those dimensions that have been proposed, the proposed dimensions still do not include technological aspects.

The development of attitude instruments and inclusive education learning concepts has become an exciting topic to discuss (Avramidis, Bayliss, & Burden, 2000; Clough & Lindsay, 1991; Angelides, 2008; Dickens-Smith, 1995; Center & Ward, 1987). The development of this instrument is based on encouraging people to form attitudes and change their perceptions of inclusive education. The evaluation results show the need for measuring one's attitude in encouraging inclusive education (Ediyanto, Atika, Kawai, & Prabowo, 2017). If efforts to introduce inclusive education so far have not changed one's views and attitudes towards inclusive education, then a new method is needed to be applied.

In the current Covid-19 pandemic, inclusive education for children who have special needs also uses virtual learning; this needs to be considered considering that children sometimes have difficulty using technology. However, understanding virtual learning materials for children who have special needs can be challenging. Therefore, based on the explanation above, it is necessary to develop an instrument that can be used to measure a person's attitude towards technology in inclusive schools for children who have special needs.

METHODS

Research and development methods used in the last ten years are complicated to find. This particular study was completed to investigate the steps of the previous research results using the development method. The research reviewed previous studies developing instruments measuring attitudes towards inclusive education. Then, eight articles were reviewed (Ediyanto 2020; Gregory & Noto 2012; Forlin et al. 2011; Stoiber

et al. 1998; Cullen et al. 2010; Sharma & Desai 2002; Monsen et al. 2015; Mahat 2008). Collection of information, initial product development, planning, validation, and revision was observed to be the four steps of the research and development method.

Information Gathering

This study discussed the instrument development assessing behavior toward technology in inclusive education. An instrument is a required crucial element (Cullen et al., 2010). Therefore, the current study is essential as it develops an instrument measuring behavior toward technology in inclusive education.

Planning

In the planning step, the instrument developed was created after articles were reviewed in online databases from the Education Resources Information Center (ERIC) (http://www.eric.ed.gov). This step presents a summary of instrument development studies.

The Development Initial Product

Successful inclusive education is indicated by people's attitude toward inclusive education (De Boer, Pijl, & Minnaert, 2011; Forlin, Sharma, & Loreman, 2007; Kurniawati et al., 2012). However, an instrument that measures behavior toward technology in inclusive education remains absent. Therefore, the first step in developing the instrument is to build as many items related to technology in inclusive education.

Validation & Revision

Content validity can be properly investigated through expert validation (Abell, Springer, & Kamata, 2009). Three experts in the inclusive education field assessed the initial instrument. An eligible instrument should have appropriate responses, be clear and balanced, and be applicable to praxis and relevant to the selected topic while avoiding wordiness, negative wording, jargon, technical language, and coinciding responses (Carmines and Zeller, 1991; Fink, 1995). Meanwhile, the initial product needs to be revised based on validator comments and suggestions. After the first revision is completed, a pilot study is essential to do. After the data had already been collected, the statistical analysis (criterion-referenced validity, construct validity, and internal consistency) was carried out utilizing SPSS 23.0 (IBM, 2015). The statistical evaluation examines instrument validity using Principal Component Analysis (PCA). PCA reduces the number of index variables from a larger item, improving interpretability, and minimizing information loss (Lever, Krzywinski, & Altman, 2017Jolliffe & Cadima, 2016). Each component's correlation was investigated through correlations analysis (Clark & Watson, 1995). The Pearson product-moment correlation test was utilized in the bivariate correlation study. Pearson product-moment correlation validity test is operated based on the concept of connecting or correlating each component. It is the most reliable method producing a minimum standard error that is estimated for any two variables regardless of their measurement (Borg & Gall, 1989). A positive and significant relationship is indicated by a correlation coefficient of a .60 or higher(Creswell, 2005). The instrument revision was carried out once the first trial was completed.

RESULTS AND DISCUSSIONS

Structure of Initial Instrument

The instrument development in the current study begins by analyzing the developments in technology in education and the COVID-19 pandemic. Technological developments and the COVID-19 pandemic have forced children with special needs to make maximum use of technology. This analysis process is carried out by several experts in a discussion group forum. The focus group discussion resulted in 21 questions, as shown in Table 1. Experts validated the 21 questions to review the quality of the content and constructs.

Table 1. Initial Instrument Assessing Behavior toward Learning Technology in Inclusive Education

Code	Statements
Q1	Students who have special needs prefer to learn online than face-to-face instruction.
Q2	Students who have special needs will more enjoy learning online than face-to-face instruction.
Q3	Students who have special needs are independent in performing tasks during online learning.
Q4	Students who have special needs are active while participating in online learning.
Q5	Students who have special needs are more interested in online learning than face-to-face instruction.
Q6	Students with special needs have difficulties in online learning.
Q7	Students who have special needs take time during online learning.
Q8	By learning online, students with special needs can learn flexibly (any time).
Q9	Online learning is more extensive than face-to-face learning since the learning resources are broader.
Q10	Students who have special needs can understand the teacher's explanation well during online learning.
Q11	Students who have special needs can perform well on all the tasks assigned by online learning.
Q12	Students who have special needs can use technology (mobile phone/laptop) to learn.
Q13	Students who have special needs can use online learning applications such as quizzes, Google classroom, etc.
Q14	Students who have special needs are not able to follow online learning
Q15	Students who have special needs are not able to understand the concept that is explaining by online.
Q16	Parents have difficulty accompanying students in online learning.
Q17	Teachers have difficulty conveying information to students with special needs during online learning.
Q18	Parents are not able to use learning technology.
Q19	The atmosphere around students with special needs is not conducive during online learning.
Q20	Students who have special needs are unable to utilize learning technology appropriately.
Q21	Parents are unable to monitor the usage of learning technology used by their children.

Experts Validity Test

Validity test results

The Validity test was carried out following 20 validation indicators. Based on experts' evaluation, each item is feasible to measure attitudes toward learning technology in inclusive education. The percentage of average scores for each validation can be found in Table 2.

Table 2 The results of the validity test

Validation Indicator	Percentage	Quality	Decision
It has a specific statement.	90.48%	Great	Very Practical
It has a straightforward statement.	91.27%	Great	Very Practical
Participants are capable of understanding the question.	89.68%	Great	Very Practical
It has no two-barreled statement (two statements in one).	90.87%	Great	Very Practical
It has a concise statement.	87.30%	Great	Very Practical
It has no required words.	90.48%	Great	Very Practical
The statement uses the affirmative (e.g., Instead of "Which processes are not implemented?", the question asks "Which processes are implemented?").	89.68%	Great	Very Practical
The response only has a single option.	90.08%	Great	Very Practical
It has an unambiguous sentence.	88.89%	Great	Very Practical
It contains an unbiased remark that does not elicit a response from the participants.	91.67%	Great	Very Practical
It has a statement with a neutral tone.	90.08%	Great	Very Practical
The statement uses understandable terms by the target population.	91.67%	Great	Very Practical
The words contain no clichés or hyperboles.	89.29%	Great	Very Practical

Validation Indicator	Percentage	Quality	Decision
It has a communicative sentence.	91.27%	Great	Very Practical
It uses correct language.	91.67%	Great	Very Practical
The sentences consist of no offensive words for readers.	91.27%	Great	Very Practical
The responses are applicable to situations or can be used to respond to unique situations.	91.67%	Great	Very Practical
It uses appropriate technical language.	92.06%	Great	Very Practical
It uses apparent technical language.	92.06%	Great	Very Practical
It has statements relevant to participants' expertise or daily practices.	91.27%	Great	Very Practical

The results of validation all item

The results of the validation of all items were based on 18 validation indicators. Based on experts' evaluation, each item is feasible to measure attitudes toward learning technology in inclusive education. The percentage of average scores for each validation can be found in Table 3.

Table 3 The results of item validity test

Validation Indicators	Percentage	Quality	Decision
The listed choices enable participants to present appropriate responses.	100.00%	Great	Very Practical
All abbreviations are defined.	100.00%	Great	Very Practical
The statements are adequate to address the selected problem.	91.67%	Great	Very Practical
The statements sufficiently answer the research questions.	83.33%	Great	Very Practical
The statements sufficiently fulfill the purpose of the study.	83.33%	Great	Very Practical
There is no overlap in the instrument view.	91.67%	Great	Very Practical
The content on the page is not overly dense.	91.67%	Great	Very Practical
It uses an appropriate font size.	91.67%	Great	Very Practical
It uses an easy-to-read font size.	91.67%	Great	Very Practical
It uses a consistent font type.	100.00%	Great	Very Practical
The instrument's instructions can be easily comprehended by the participants.	100.00%	Great	Very Practical
Participants are capable of answering the instrument quickly.	91.67%	Great	Very Practical
It uses a consistent navigation system throughout the instrument.	91.67%	Great	Very Practical
The statements are not repeated.	91.67%	Great	Very Practical
It uses a sufficient number of questions in measuring attitudes toward inclusive education.	100.00%	Great	Very Practical
The participants can easily fill out the instrument following the instruction on the first page.	100.00%	Great	Very Practical
The inclusive education definition on the first page provides clear illustration.	91.67%	Great	Very Practical
On the first page, the direction helps the teacher to fill out the instrument quickly.	91.67%	Great	Very Practical

Notes: The validation was carried out by three experts.

Pilot Study

The pilot study examines the construct validity and internal consistency. Twenty-one items were used for the pilot study (See in Table 4). A pilot study has been completed

on 112 pre-service teachers in Malang, Indonesia. These participants are 18 to 22 years old, with 23.3 and 76.7% of them being male and female.

SPSS 23.0 (IBM, 2015) and and Principal Component Analysis (Field, 2009) were selected to examine the construct validity of the 21-item data set. The dataset acquired from the sample of 112 participants was subjected to a component analysis to determine its unidimensionality. To analyze the underlying structure and minimize the items' inter-component correlation, Varimax rotation with Kaiser normalization of the initial PCA was used (Tabachnick & Fidell, 2007). In the first trial, the final component loading with a cutoff point of 0.4was suitable for data analysis.

The principal component analysis result is a scale consisting of six elements and 22 items. The measurement of sampling adequacy yielded a KMO value of 0.802. The overall variance explained value was 55.318%. Three components were identified as a result of a PCA test on a set of items (Table 4). The reliability of the instrument is 0.792.

Table 4 The Principal Component Analysis Results in Pilot Study

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.875	27.977	27.977	5.234	24.924	24.924
2	4.000	19.047	47.024	4.413	21.016	45.939
3	1.742	8.294	55.318	1.970	9.379	55.318

Rotated Component Matrix

No	Revised Statement	1	2	3
Q4	Students who have special needs are active while participating in online learning.	**.884**	-.108	-.030
Q5	Students who have special needs are interested in online learning.	**.850**	-.015	-.019
Q2	Students who have special needs will enjoy online learning.	**.803**	-.022	-.037
Q1	Students who have special needs prefer online learning.	**.786**	-.102	-.038
Q3	Students who have special needs are independent in performing tasks during online learning.	**.765**	-.191	.070
Q11	Students who have special needs can perform well on all the tasks assigned by online learning.	**.677**	-.061	.209
Q9	Online learning is effective since the learning resources are broader.	**.672**	.030	.231
Q10	Students who have special needs can understand the teacher's explanation well during online learning.	**.665**	-.035	.178
Q8	By learning online, students who have special needs able to learn flexibly (any time).	**.475**	.144	.304

Rotated Component Matrix

No	Revised Statement	1	2	3
Q19	The atmosphere around Students who have special needs is not conducive during online learning.	.038	**.787**	-.174
Q17	Teachers have difficulty conveying information to students who have special needs during online learning.	-.122	**.768**	.053
Q16	Parents have difficulty accompanying students in online learning.	-.052	**.731**	-.149
Q20	Students with special needs are unable to utilize learning technology appropriately.	.033	**.721**	-.431
Q18	Parents are not able to use learning technology.	-.052	**.687**	-.056
Q21	Parents are unable to monitor the usage of learning technology used by their children.	.070	**.663**	-.099
Q15	Students who have special needs are not able to understand the concept that is explaining by online.	-.152	**.574**	.266
Q6	Students who have special needs have difficulties in online learning.	-.185	**.560**	.338
Q14	Students who have special needs are not able to follow online learning.	.026	**.532**	-.063
Q7	Students who have special needs take time during online learning.	-.116	**.427**	.269
Q13	Students who have special needs can use online learning applications such as quizzes, Google classroom, etc.	.286	-.160	**.808**
Q12	Students who have special needs are able to use technology (mobile phone/laptop) to learn.	.353	-.142	**.756**
Cronbach's alpha		0.898	0.845	0.838
No. of items for Cronbach's alpha		9	10	2

Note: Pattern of the matrix of the principal component analysis (PCA, varimax with Kaiser normalization). N = 112 pre-service teachers. All item in this table is the last version in the current study.

Revise

In general, the instrument utilized in this investigation met the criteria set out by experts during the validation procedure. Despite the fact that each item is practicable and requires no alteration, the experts' criticism and ideas must be taken into account. The revision process lies in developing the instrument, by the addition of children who have special needs characteristics as students who have no intellectual disabilities. Based on the opinion of experts, most of the statements in comparing a situation with other situations. These statements are located in item numbers 1, 2, 5, and 9. The comparison statement needs to be changed in the editorial form instead of a comparison sentence.

One of the ways to create an acceptable learning environment for all students is to establish a class with a universal design so that all students have physical access to all materials and activities without the child experiencing difficulties. Technology plays a vital role in education in accordance with the sustainable development goals (SDGs) to answer the demands of world leadership in overcoming inequality (Kosakowski, 1998). Several studies state that universal design is a teaching approach beneficial for inclusive education and produces a fundamental tool for achieving sustainable development goals (Diaz, Moreno & Lopez, 2020). Other research shows that universal designs effectively involve all students, including people who have special needs. However, teachers with basic knowledge of universal design are observed needing more practice and training to

meet the students' needs successfully, including students who have disabilities (Almumen, 2020; Katz & Sokal, 2016; Love, Baker, & Devine, 2019).

On the other hand, García, Canabal, & Alba (2020) explain that Universal instructional design is a framework that promotes progress toward removing barriers to learning and student engagement, as well as providing classroom practice guidelines that can help students develop their executive abilities. The reinforced by research from Lanterman & Applequist (2018) shows that universal instructional design training may have substantial and constructive effects on pre-service teacher perception of disability. This belief in pre-service teachers is more likely to result in more supportive teaching practices for students who have specific needs in a common learning class.

One of the essential factor in providing inclusive practices for students with special needs is a well-prepared teaching staff (Stayton, 2015; Yu, 2019; Sharma, Forlin, & Loreman, 2008). Other research has also revealed that inclusive classroom teachers should have the necessary knowledge about instructional adaptation, adapt to the curriculum for inclusive students, and help students with special needs gain achievement from the effectively adapted curriculum (Sahan, 2021). Previous studies have shown that teachers' positive attitudes significantly influence the success of inclusive education. In implementing inclusive education, the teacher is an essential element that influences students to learn effectively. Inclusion tends to be successful if all students receive a teacher's positive attitude, (Monsen, Ewing, & Kwoka, 2014; Yu, 2019; Lambe & Bones, 2006). There is a connection between teachers' attitudes toward providing an environment that is acceptable to all children (Symeonidou, & Phtiaka, 2009; Agbenyega, 2007; Donohue & Bornman, 2015). In inclusive education, teachers can be assisted by special assistant teachers, who are responsible for assisting the teaching for students who have special needs in the classroom (Widodo, Indraswati, Sutisna, Nursaptini, & Novitasari, 2020). A Special Guidance Teacher is a pillar supporting inclusive education. It means that the existence of GPK in inclusive schools will be one of the success factors because it can strengthen and strengthen the implementation of inclusive education programs (Zakia, 2015).

The curriculum used to create an acceptable environment for all students is flexible (Opertti, & Brady, 2011; Ghergut, 2012; Mitchell, 2015). Learning focuses on designing diverse learning experiences to help optimize learning opportunities for all students. Through individualization and adaptation of learning materials made possible by open educational practices and flexibility of resources for the benefit of all students (Mukminin, Habibi, Prasojo, Idi, & Hamidah, 2019). The need for modification of learning materials and media following the students who have special needs in inclusive schools to realize acceptable learning for all students (Kuyini, & Desai, 2008; Orr & Hammig, 2009; Ally, 2019).

An environment that is acceptable to all students needs to consider a classroom environment adapted to students' needs to ensure that it has facilitated the academic, technology, and social needs of all students. In establishing an acceptable learning environment for all students, facilities and infrastructure in schools must also be supportive (Genc, & Kocdar, 2020; Bakari, 2017; Ncube, & Hlatywayo, 2013). The fulfillment of facilities and infrastructure greatly affects the comfort of the environment in the school. Without supporting facilities, learning cannot run comfortably.

Support from the surrounding environment is also very influential in realizing an environment that all students can accept. For example, with support from peers in implementing inclusive education, students with special needs can be helped by peer teaching (Hasan, Handayani, & Psych, 2014). Another study explained that support from parents, teachers, the community, and the government also greatly influenced realizing a suitable environment for all students (Epstein & Sanders, 2002, Sahnita, 2017;

Rahman, 2010). The support from various parties will make children feel accepted in the learning environment.

CONCLUSIONS

In the current study, an instrument to assess attitudes toward learning technology in inclusive education has been developed. The development creates a learning environment appropriate for all students. The following main stages of development were used to create this instrument, data collection, planning, initial product development, validation, and revision.

Results of validation by three experts show that the developed instrument measuring the behavior of Indonesian teachers towards inclusive education has followed requirements of content validity. Therefore, each item are eligible with feasible quality.

The current instruments contained 21 items, which were grouped into three components. The determination of the terms of the three components will be carried out in further research. The findings suggest that the instrument is reliable and valid. The process of validation was carried out in a pilot study involving 112 pre-service teachers. The instrument attains the smallest principal component analysis of 0.427 and Cronbach's alpha value of 0.792, classified as reliable.

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