

ORIGINAL ARTICLE

The Verification of the Reliability and Construct Validity of the Disability Awareness Program (DAP) scale:

Analysis of Cross-sectional Data and Longitudinal data

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ABSTRACT

This study aimed to verify the reliability and construct validity of Disability Awareness Program (DAP) scale in a multicenter setting for students wishing to become teachers in the future. Cross-sectional data and longitudinal data were collected at University in Yamaguchi and Miyazaki, Okinawa, Miyagi prefecture between January 2020 to May 2020. The reliability of DAP scale was verified via the internal consistency method; the coefficient of Cronbach's α were over 0.7 (0.829 for all items).

The validity of DAP scale was also verified via one-way repeated-measures ANOVA and the latent growth curve model. The total scores of DAP scale obtained from one-way repeated-measures ANOVA were the same as the predicted scores. DAP scale is valid based on its goodness-of-fit values obtained using the latent growth curve model, the values of comparative fit index and root mean square error of approximation were within the goodness-of-fit range (CFI=0.998, RMSEA=0.017). These results indicate that DAP scale has high reliability and construct validity.

< Key-words >

scale development, disability awareness program, Disability Awareness Program (DAP) scale, reliability, construct validity

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I. Introduction

In present, the number of students with disability advancing to higher education institutions is on the rise. According to statistics, in 2019, the number of disabled students was 37,647 (33,812 in the previous fiscal year), which is 1.17% (1.05% in the previous fiscal year) of the total 3,214,814 students.¹⁾ In addition, due to advances in medicine, the number of people with disabilities participating in society is increasing.

Disability awareness program is defined a program that increases awareness of disability in healthy individuals, including children and adults, and promotes changes in awareness and attitudes towards persons with disabilities.²⁾ Disability awareness program is carried out in the higher educational institution, Junior high school, and elementary school. In the higher educational institution, disability awareness program implements mainly for student that hope to become professionals like medical students or nursing students. Moreover, DAP for medical schools enforce programs focused on specific diseases. Specialized content is included in the program, and evaluation items are also specialized content.

Bu et al. conducted disability awareness program for total of 488 third-year medical students. in this study, divided into Intervention Group (n = 237; 109 females, 115 males) and Control Group (n = 237; 122 females, 97 males) and using evaluation scale that the Disability Attitudes in Health Care scale.³⁾ It consists of addresses general attitudes, cost effectiveness, therapeutic potential, and educational preparation of healthcare professionals caring for person with disabilities. This session was given every 6 weeks. Prior to the session, the students were asked to watch Ten Commandments of Communicating with disability person, a 26-minute video teaching disability etiquette. McConville et al. conducted disability awareness program for total of 145 nursing student University of Wolverhampton (age range 18-45 years) using evaluation scale that A six-item self-efficacy toward nursing scale⁴⁾.

All the aforementioned disability awareness program studies targeted Medical and nursing students, whereas studies investigating the effectiveness of disability awareness program specifically in college students are scarce. In particular, it is necessary to develop a disability awareness program for students majoring in education. Because when Students major in education become teacher after graduation from university, they often meet child with disabilities as their student.⁵⁾

However, disability awareness program was mainly practiced in the medical field are aimed at communicating with patients and are difficult to practice like students in other disciplines. Moreover, disability awareness program practiced at the School of Medicine consisted of specialized content and evaluation scale focused on specific disability types. It is difficult to implement it for university students other than the medical school, and there is no evaluation method for the content of the implementation. Thus, it is necessary to revise the specialized content and develop a new evaluation scale for disability

awareness program from a sociological point of view.

In addition, college students other than medical students also need a program that takes into consideration the involvement of people with disabilities. OTA et al. developed a disability awareness program scale (DAP scale) that comprehensive evaluating disability awareness program for university students wishing to become teachers in the future.⁶⁾ Although the content validity of the DAP scale has been verified, content validity is a subjective opinion, scientific validation of reliability and construct validity is required. Moreover, it is necessary to collect data in multiple facilities, because one facility is insufficient. Therefore, the aim of this study was to verify the reliability and construct validity of DAP scale in a multicenter setting for students wishing to become teachers in the future.

II. Methods

1. Study Design

Cross-sectional data is used to calculate reliability factors in typical scaling steps, and longitudinal data is used to validate construct validity.⁷⁾ In this study, the term DAP scale is used as the scale developed by the author. The DAP scale data is collected in a cross-sectional and longitudinal. A package containing manuals was sent to researchers who explained the objectives and methods of the survey and obtained consent to participate. DAP scale packages were sent to university of teacher training course in Miyagi, Yamaguchi, Miyazaki, and Okinawa prefectures was conducted.

2. Questionnaire

Questionnaire is used DAP scale developed by OTA et al.⁶⁾ DAP scale administered has three areas (basic human rights awareness, disability awareness, and diversity awareness) to measure changes in students' awareness of Disability Awareness Program.

DAP scale is evaluated on the five grades, 1= "Strongly disagree", 2= "Disagree", 3= "Neither agree nor disagree", 4= "Agree a little" and 5= "Strongly agree".

3. Process

Research collaborators from all four universities are informed of their research objectives and implementation procedures, and after a research collaboration agreement was obtained. After obtaining consent, the study summary briefing material, DAP scale, and student study collaboration consent form were filed and sent to the research collaborators. The research collaborators explained to the students who were the subjects of the data collection before the lesson based on the research summary explanatory material. The explanation contents are freedom of the research participation, withdrawal of the consent, consultation counter, outline and purpose of the research, research method

and period, selection method of the subject, handling of the personal information, and publication of the result. After completing all the explanations, only the students who obtained the consent were implement DAP scale. Classes were held based on an implementation manual from November 2019 to March 2020, collected by mail from January 2020 to May 2020.

1) Cross-sectional data

Cross-sectional data without intervention are collected at University in Yamaguchi and Miyazaki prefecture. Data obtained at the first time at University in Miyagi and Okinawa prefecture were also treated as cross-sectional data and used to calculate a reliability.

2) Longitudinal data

Longitudinal data by intervention are collected at University in Miyagi and Okinawa prefecture. University in Miyagi and Okinawa prefecture, which cooperated in collecting longitudinal data, were sent implementation manuals and lesson materials on the content of the intervention.

4. Intervention

The intervention was performed to collect longitudinal data. The content of classes about longitudinal data interventions was plan based on scaled areas. DAP scale implemented before class intervention as a baseline, and after classes intervention three times. Lesson materials include content related to “basic human rights”, “ICF”, and “diversity”, which are areas of DAP scale, and consisted of a total of three classes. In the execution manual, the explanation was described on questions based on the lesson material and discussion method, and the answer when the question was asked from the student.

5. Statistical analysis

1) Reliability of DAP scale

The internal consistency method was utilized, and Cross-sectional data were employed to verify the reliability of DAP scale. Cronbach’s α value was used for the internal consistency of DAP scale. Cronbach’s α is a factor that measures the reliability and internal consistency of the most used measures. A minimum Cronbach’s α co-efficient of 0.7 was considered satisfactory for group-level comparisons.⁸⁾

2) Validity of DAP scale

For this study, the latent growth curve model, which is one of an experimental intervention method, and structural equation modeling (SEM), among the methods of construct validity, were utilized, and longitudinal data were employed to verify the validity of DAP scale. Constructs can become bases of validity when they succeed in

predicting the changes after experimental interventions, and a tool for measuring constructs reflects the changes that occurred, if any.⁹⁾ That is, the total score of DAP scale is expected to increase when the educational outcome is longitudinally measured because DAP scale is a tool for evaluating disability awareness program outcomes. To analyze the obtained data, one-way repeated-measures ANOVA were used. SPSS ver.23.0 was used for statistical analysis.

The latent growth curve model can be used to analyze the repeated-measures data, which is different from general path analysis.¹⁰⁾ In the latent growth curve model, unlike in general path analysis, path coefficients are not the subjects of the data analysis because all the path coefficients from the observed to the latent variables are fixed parameters.¹¹⁾ The goodness of fit of the model was evaluated with the following goodness-of-fit indicators: Comparative Fit Index(CFI) and Root Mean Square Error of Approximation(RMSEA). When conducting analysis via SEM, the researchers themselves are to choose the fit index that they would use, based on their judgment. A model is considered acceptable, when two or more fit indices are met including RMSEA.¹²⁾ The model goodness-of-fit criterion for RMSEA is $RMSEA < 0.1$, $RMSEA < 0.05$ is in a very good range.¹³⁾ The model goodness-of-fit criterion for CFI is $CFI > 0.90$, and $CFI > 0.95$ is in a very good range.¹³⁾¹⁴⁾ The maximum likelihood method was used for the estimation of the parameters. Amos ver. 23.0 was used for statistical analysis.

6. Ethics

Based on the Declaration of Helsinki, this study was carried out by preparing a protocol describing appropriate academic and ethical considerations and obtaining the approval of the Ethical Review Board of the academic conference (No.2019-1-928).

III. Results

1. Subject characteristics

118 longitudinal data and 165 cross-sectional data were collected in this study. Among the 165 cross-sectional data, the first data of 118 longitudinal data is included. All data were collected in Miyagi, Yamaguchi, Miyazaki, and Okinawa prefectures.

The average age of longitudinal data was 19.38 ± 1.15 and the gender rate was 37 males (31.4%), 81 females (68.6%). Regarding whether with disabilities, 5 students (4.2%) answered "yes" and 112 students (94.9%) answered "no". Regarding opportunities to interact with people with disabilities, 49 students (41.5%) answered "Not at all", 27 students (22.9%) answered "1-3 times a year", 22 students (18.6%) answered "1-3 times a month", 9 students (7.6%) answered "1-3 times a week", and 11 students (9.3%) answered "almost every day" (Table 1).

The average age of cross-sectional data was 19.61 ± 1.37 and the gender rate was 52 males (31.5%), 109 females (66.1%), and 4 non-responders (2.4%). Regarding whether with disabilities, 8 students (4.8%) answered “yes” and 151 students (91.5%) answered “no”, and 6 non-responders. Regarding opportunities to interact with people with disabilities, 58 students (35.2%) answered “Not at all”, 34 students (20.6%) answered “1-3 times a year”, 30 students (18.2%) answered “1-3 times a month”, 26 students (15.8%) answered “1-3 times a week”, and 13 students (7.9%) answered “almost every day”, 4 non-responders (2.4%) (Table 1).

<Table 1> Characteristics of the participants that has used DAP scale

		longitudinal data	cross-sectional data
All		118	165
Age \pm SD		19.38 ± 1.15	19.61 ± 1.37
Gender, n(%)	Male	37(31.4)	52(31.5)
	Female	81(68.6)	109(66.1)
	Non-response	0(0.0)	4(2.4)
Whether with disabilities, n(%)	Yes	5(4.2)	8(4.8)
	No	112(94.9)	151(91.5)
	Non-response	1(0.8)	6(3.6)
Opportunities to interact with people with disabilities, n (%)	Not at all	49(41.5)	58(35.2)
	1-3 times a year	27(22.9)	34(20.6)
	1-3 times a month	22(18.6)	30(18.2)
	1-3 times a week	9(7.6)	26(15.8)
	Almost every day	11(9.3)	13(7.9)
	Non-response	0(0.0)	4(2.4)

2. Reliability of DAP scale

165 cross-sectional data were collected to verify reliability. The Cronbach’s α value, which is the reliability coefficient of internal consistency, was 0.831 for the “basic human rights awareness” area, 0.856 for the “disability awareness”, and 0.945 for the “diversity awareness” in each area. In addition, it was 0.829 for all items (Table 2). The reliability of DAP scale was verified via the internal consistency method.

< Table 2 > DAP scale scores and reliability score

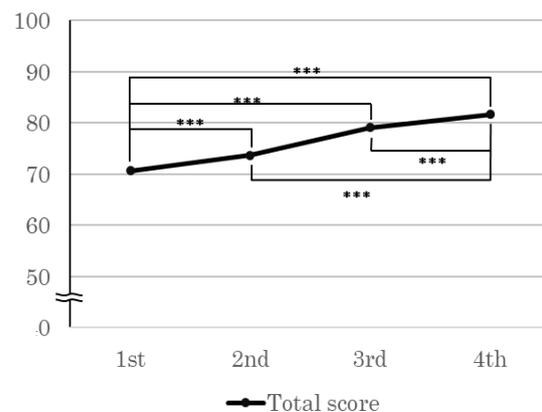
Constructs	Mean	SD	Cronbach's alpha if item deleted	Cronbach's α
Basic human rights awareness				0.831
Q1	3.63	1.154	0.801	
Q2	4.32	0.903	0.816	
Q3	3.61	1.140	0.798	
Q4	4.05	0.980	0.772	
Q5	3.88	1.130	0.797	
Disability awareness				0.856
Q6	3.95	1.083	0.828	
Q7	4.22	1.008	0.847	
Q8	3.36	1.371	0.857	
Q9	3.75	1.074	0.823	
Q10	3.69	1.161	0.814	
Q11	3.50	1.252	0.819	
Diversity awareness				0.945
Q12	4.53	0.914	0.935	
Q13	4.45	0.984	0.930	
Q14	4.38	1.002	0.917	
Q15	4.48	0.979	0.932	
All item				0.829

3. Validity of DAP scale

1) Validity determined via the experimental intervention method

The experimental intervention method was set as the first one before the lesson, the second one after the “lesson on human rights”, the third one after the “lesson on disability”, and the fourth one after the “lesson on diversity”.

118 longitudinal data were collected to verify construct validity. In the results of the experimental intervention, the total scores average of DAP scale significantly increased (Fig. 1). The total scores average changed from 70.66 (SD=0.94) before the lesson, to 73.66 (SD=1.01) after first lesson, 79.08 (SD=1.22) after second lesson, and 81.66 (SD=1.13) after third lesson. In the results of the analysis through one-way repeated-measures ANOVA, there were significant differences between the first and second ($p < .001$), the first and third ($p < .001$), the first and fourth ($p < .001$), the second and third ($p < .001$), the second and fourth ($p < .001$), the third and fourth ($p < .001$). Based on the above results, the prediction of total score of DAP scale was confirmed, and the construct validity by the experimental intervention method, which is one of the verification methods of construct validity, was verified.

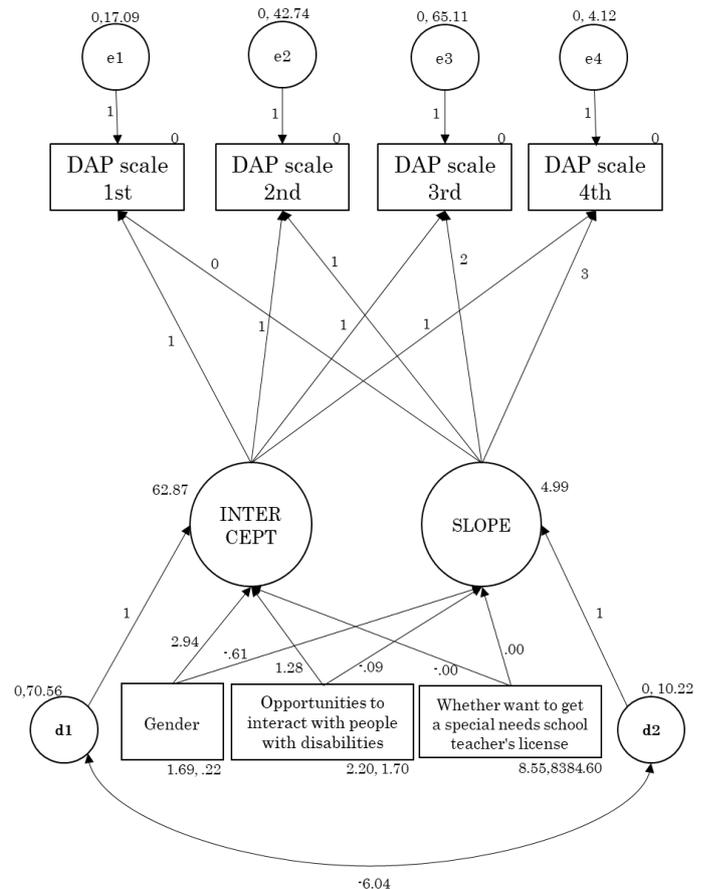


< Figure 1 > Changes of the total score of DAP scale, one-way repeated measures ANOVA was used, *** $p < .001$, n = 118

2) Validity determined via the latent growth curve model

The latent growth curve model was verified using “gender”, “age”, “whether with disabilities”, “opportunities to interact with people with disabilities”, and “whether want to get a special needs school teacher’s license” as explanatory variables.

As for the Validity analysis via the latent growth curve model, DAP scale showed a high level of fitness: $\chi^2 = 14.447$; degree of freedom (DF) = 14; CFI = 0.998; and RMSEA = 0.017. The validity was verified because the values of CFI and RMSEA were within the goodness-of-fit range.



<Figure 2> Latent curve analysis of DAP scale
DF, degree of freedom; CFI, comparative fit index; RMSEA, root mean square error of approximation. n = 118, $\chi^2 = 14.447$, DF = 14, CFI = 0.998, RMSEA = 0.017.

As for the factors affecting DAP scale scores, three factors were clearly identified: “gender”, “opportunities to interact with people with disabilities”, and “whether want to get a special needs school teacher’s license”. This means that the three explanatory variables affect the outcome of disability awareness program (Fig. 2).

IV. Discussion

Due to advances in medicine, the number of people with disabilities participating in society is increasing. Disability awareness program is aimed to increases awareness of disability in healthy individuals, including children and adults, and promotes changes in awareness and attitudes towards persons with disabilities.²⁾ In particular, it is necessary to develop a disability awareness program for students majoring in education.⁵⁾ In the higher educational institution, Disability awareness program implements mainly for student that hope to become professionals like medical students or nursing students.³⁾⁴⁾

However, it is difficult to practice like students in other disciplines, as these disability awareness program were specialized content is included in the program, and evaluation items are also specialized content. In addition, college students other than medical students also need a program that takes into consideration the involvement of people with disabilities.

In this context, DAP scale, a tool that comprehensive evaluating disability awareness program for university students wishing to become teachers in the future, was developed, and its reliability and validity were verified in this study. The present study was the first attempt to develop a tool for evaluating the disability awareness program combined with ICF, diversity. It is also the first study to be conducted to collect data in multiple facilities, and identify the factors affecting the disability awareness program using the latent growth curve model.

The reliability of DAP scale was verified via the internal consistency method; all areas and all items, the coefficient of Cronbach's α were over 0.7 (0.829 for all items). As for the verification of construct validity, the high level of construct validity of DAP scale was confirmed using the experimental intervention method and the latent growth curve model. One-way repeated-measures ANOVA were used to observe the changes in the educational outcomes using the experimental intervention method. In the results, the total DAP scale score significant differences between all class ($p < .001$). The fitness level of the model was found to be high in the results of its analysis using the latent growth curve model (CFI = 0.998, RMSEA = 0.017). As for the factors affecting the scores, three factors were clearly identified: gender, opportunities to interact with people with disabilities, and whether want to get a special needs school teacher's license.

A study for students majoring in another specializations needs to be conducted, because in this study, target for students majoring in education. Moreover, it is necessary to implement an intervention other than in this study and identify an effective disability awareness program. This study also had a regional limitation because the data for the study were collected only within four Prefecture in Japan. And an evaluation model for the disability awareness program needs to be established via nationwide data collection in Japan, and the evaluation scale to be used for such model needs to be standardized.

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