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AN INVENTORY TO ASSESS EMPATHIC CONCERN FOR DISABILITY AND ACCESSIBILITY: DEVELOPMENT AND PRELIMINARY PSYCHOMETRIC INVESTIGATION

Motohide Miyahara[1], Yukinori Sawae[2], Hahna Briggs[1], Rebekah Wilson[1], Koichiro Doihata[2], Ayano Sugiyama[2]

[1]School of Physical Education, Sport and Exercise Sciences, University of Otago, Dunedin, New Zealand

[2]Institute of Health and Sport Sciences, University of Tsukuba, Tsukuba, Japan

[1]motohide.miyahara@otago.ac.nz, [2]sawae.yukinori.ka@u.tsukuba.ac.jp, [3]hahna@ousa.org.nz, [4]rebekah.wilson719@gmail.com, [5]s1530493@u.tsukuba.ac.jp, [6]sugiyama.ayano.gp@u.tsukuba.ac.jp

Abstract: Cultivating empathy and prosocial attitude towards disability is a first step for university students to become the leaders of society and professions to create accessible environments and inclusive society. Gauging levels of empathy and prosocial attitude towards disability among the students is important for evaluating the adequacy of disability training and education. We developed and conducted an initial psychometric validation of a novel inventory in Japanese and English languages to assess Empathic Concern for Disability and Accessibility (ECDA) in Japan and New Zealand. Preliminary psychometric evaluation indicates strong internal consistency in the Japanese sample (α = .96) and the New Zealand sample (α = .93). Exploratory factor analysis demonstrated a four-factor solution for both samples. The present study has resulted in the development of the ECDA that demonstrated initial support for internal consistency and construct validity. The ECDA may be used for the cross-cultural comparisons of disability training and education.

Keywords: empathy; prosocial attitude; reliability; validity

Introduction

Accessibility is a significant factor in the success of public spaces (Pasaogullari & Doratli, 2004), which in turn contribute to health and quality of life (Rogers, 2003). Although broad accessibility is mandatory in most developed nations' public spaces (United Nations, 2013), many citizens, such as people with impairments of mobility and vision, are still impeded as a result of disabling environments (Mulligan, Miyahara, & Nichols-Dunsmuir, 2017). Accessibility features, such as ramps and audible signals, are essential; but sometimes human assistance can also be vital. Noticing a person being impeded by an inaccessible public environment, many onlookers would empathise with the person and try to help. Whether or not they will actually take action, however, depends on a variety of factors. One important factor for predicting helping behaviour is empathic concern that "is aroused when someone experiences a close bond with another, and it motivates altruistic behaviour, which is directed primarily at improving the other person's welfare" (Twenge, Baumeister, DeWall, Ciarocco, & Bartels, 2007, p. 62), or to be more specific, the ability to empathise with the victims of circumstance and the attitude or readiness to engage in prosocial behaviour by assisting them in the inaccessible environment. Here, we seek to develop a prosocial attitude scale, namely empathic concern for disability and accessibility (ECDA), to measure such specific empathic concern for people with impairments who are disabled by inaccessible environments. The developed scale can be used for future cross-cultural evaluation of disability training and education.

The prosocial attitude of support providers towards people with disability has been investigated not so much from the perspective of promoting prosocial behaviours as the perspective of preventing the support providers' burnout and maintaining their well-being. If support providers or helpers have true altruistic motivation, or empathic concern (Batson et al., 1991), the helpers will empathise with support recipients, imagining how the recipients would be feeling. In contrast, if helpers' motivation involves egoistic considerations, such as a desire to reduce their own discomfort of facing individuals who experience disability, the helpers' imagination is focused on how the helpers themselves would be feeling and thus taking the risk of personal distress (Batson, Early, & Salvarani, 1997). Increased mindfulness of emotional separation from support recipients is critical as a preventative measure for service providers' burnout and as a maintenance factor of their well-being (Bazzano et al., 2010; Thomas & Otis, 2010). However, it is necessary to find ways to promote prosocial behaviours for interdependent humanity (Burke, 2011) because disability is a social feature which is highly transient and unpredictable in nature throughout our life (Siebers, 2008). We all can be disabled at any point of our life: Unless we create a disability-friendly societal environment, we have to eventually pay the consequences.

Empathy and prosocial attitude towards people with disability should be cultivated in disability training and education as a key feature to creating an accessible society and environment, and disability training and education are paramount for university students who are expected to become the leaders of society and professions (Mulligan et al., 2016; Myers, 2009; Stachura & Garven, 2007). Among other disciplines of university education, physical education and sport sciences have unique roles to play in accessibility issues because sports and exercise involve not only the cognitive and psychosocial domains, but also emphasise the physical domain of human faculties. The vision of the Paralympic Movement, as an example, includes the component to "touch the heart of all people for a more equitable society" (International Paralympic Committee, 2016), which should be an integral part of the curriculum of physical education and sport sciences. The authors of the present study were particularly interested in gauging the current status of and to monitor the change of prosocial attitude towards disability as a result of intervention, such as a Paralympic education, for physical education and sport science major students. In the absence of such a specific scale to assess prosocial attitude and its change as a result of intervention, a new measurement tool needs to be developed.

Two recent reviews of available instruments to measure general attitudes towards disability have confirmed that there is a lack of a scale which specifically measures empathic concern for disabled people. A systematic review (Lam et al., 2010) identified seven instruments to measure attitudes of general adult populations, healthcare students and professionals towards patients with physical disability. The most recent scoping review (Palad et al., 2016) also identified several instruments, with some overlaps with the ones included in the systematic review (Lam et al., 2010), which measure attitudes towards disability. The available instruments measured the attitudes of the general population, persons with disabilities, adults, children, health professionals, and students toward intellectual disability, communication disability, or disability in general. The scoping review (Palad et al., 2016) pointed out the limited psychometric properties of the measurement tools, as well as the lack of data on responsiveness to change and on cross-cultural validity. To address these limitations, we aimed to develop a series of visual stimuli to represent persons with impairments in accessible (i.e., non-disabling) and inaccessible (i.e., disabling) environments and to pilot test a scale to measure helping intention towards them for future use in intervention research to detect changes in the prosocial attitude of university students in Japan and New Zealand. These two nations were considered as good candidates for comparison because they differ considerably on Hoftede's (2001) key cultural dimensions.

Methodology

The multi-centre, cross-cultural study had four phases: Phase 1. Constructing vignettes and generating an item pool; Phase 2. Reviewing the item pool and determining the format for measurement; Phase 3. Administering items to pilot samples, evaluating and finalizing items; Phase 4: Evaluating items. We will describe the procedures and the outcomes of Phase 1-3, and the procedure of Phase 4 in this section.

Phase 1: Constructing vignettes and generating an item pool

The first step in developing a stimulus pool involved building approximately 100 vignettes representing 50 examples of persons with impairments in accessible (i.e., non-disabling) and 50 in inaccessible (i.e., disabling) environments. This collection was assembled by four research staff members searching, collecting, and taking photographs of such situations, and by consulting with five stakeholders. Three experts in adapted physical activity and a former teacher and tour conductor who had worked with people with disabilities searched on internet websites for suitable photographs and written descriptions with English or Japanese search terms, such as a combination of disability and inaccessible. While searching, they consulted with three persons with physical or visual impairment, and two disability workers (an occupational therapist and a volunteer worker) for ideas on disabling environments and the content validity of identified photographs. If suitable photographs were unavailable, two of the four research staff members took appropriate photographs, either by themselves or accompanied by a person with disability. A master list of 473 photos and verbal descriptions was compiled in a spreadsheet and uploaded to cloud storage serving as a shared virtual computer drive accessible from each research staff member's computer.

Phase 2: Reviewing the item pool and determining the format for measurement

Content validity, meaningfulness to university student viewers in both New Zealand and Japan, and insights into common themes of the 473 photos were generated from qualitative inquiry into disability and accessibility by a panel of the three research staff members in New Zealand and three members in Japan. The first author either met face to face, or communicated by e-mail with the five research staff members, and asked about the content adequacy of accessible and inaccessible situations, and the nature of impairment. As a result, the panel members reached a consensus that (1) impairments should be limited to impairment in mobility and vision, so that an average university student could understand and imagine the situations easily; (2) a person with impairment should not appear in the photographs, to avoid the confoundings inherent in gender, age, ethnic group, etc.; (3) a person with impairment in mobility or vision should be described in written words as “a wheelchair user”, “a person using a white cane”, etc.; (4) the format of measurement would be a four-point Likert scale with response anchors of 1: Not at all, 2: A little, 3: Moderately and 4: Very much, to the question: “Please watch a series of slides on the screen and circle a number to describe the extent you would like to help the person right after watching each slide”; (5) 50 pairs of accessible and inaccessible conditions in similar places (e.g., a pathway with and without an obstacle), with each slide being displayed for a period of six seconds, would be appropriate to answer the question about helping intention with a four-point Likert scale.

Phase 3: Administering items to pilot samples, evaluating and finalizing items

Members of a focus group, consisting of three university students in Japan and three university students in New Zealand, individually went through all 100 items. The Japanese participants informed the second author (YS) and the New Zealand participants informed the fourth author (RW) of any confusion or ambiguity in the photographs and verbal descriptions, and how quickly and accurately they were able to rate each slide. The participants reported that it took too long and was too tiring to view 100 items. Consequently, the number of items was reduced to 60 (30 pairs of accessible and inaccessible conditions) by excluding 40 items that the participants found ambiguous, repetitive, or culturally irrelevant.

Phase 4: Evaluating items

Participants

We used convenience samples of 127 (76 males, 51 females) Japanese, and 104 (48 males, 56 females) New Zealand physical education major undergraduate students of the second and the first authors respectively. Although the scale was not specifically developed for physical education and sport science major students, but for university students in general, we thought our samples were adequate for examining the internal consistency and construct validity for pilot validation. The Japanese participants were all native Japanese, including a student with a long-term physical disability. The New Zealand sample consisted of one Australian, five Europeans, 95 New Zealanders, two Pacific Islanders, and one South African. In terms of ethnic background, 87 participants identified themselves as New Zealand Europeans, and 11 participants as Maori, and one participant as a Pacific Islander. Obviously, some New Zealand participants had multiple citizenship and multicultural backgrounds. With respect to disability, four New Zealand students had long-term disabilities, encompassing the following domain areas of the New Zealand Census: seeing, walking, hand use, learning, and communication. None of the ethnicity and disability minority students in either Japan or New Zealand was an outlier on the measures described below. Hence, the minority students were grouped together as part of their respective cultural groups of Japan and New Zealand, and the participants were grouped only with respect to culture.

Measures of helping intention

The final set of 60 items, derived as explained in Phase 3, were used in both Japan and New Zealand. The verbal descriptions were written in Japanese and English in Japan and New Zealand respectively. A written description displayed on each photograph slide stated the type of impairment to be considered (either mobility or visual impairment) and why the person was disabled or not due to an environment (see Figure 1). After viewing each photo slide with its verbal description, participants were asked how much they wished to help the person described on the slide on the scale of 1 (not at all), 2 (a little), 3 (moderately) and 4 (very much).

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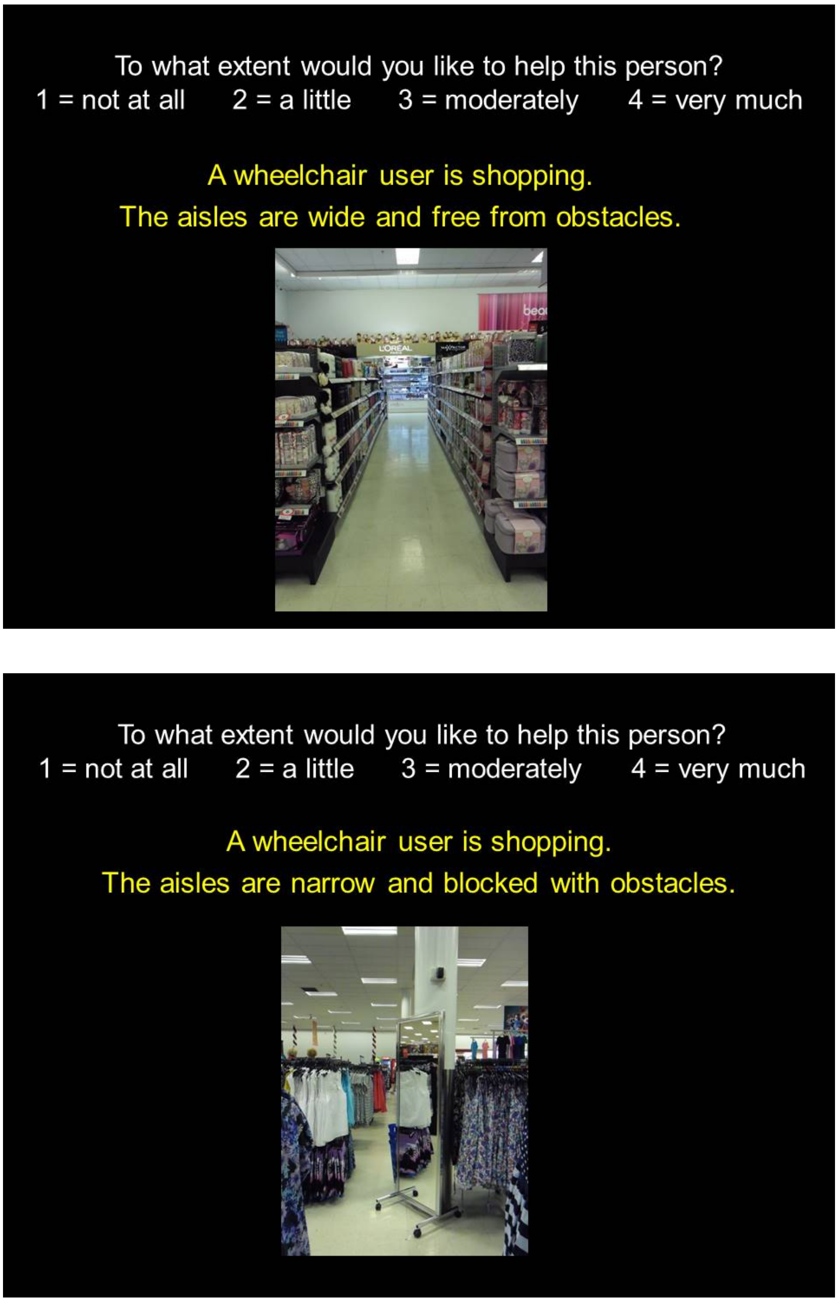
Figure 1. Exemplary items of Empathic Concern for Disability and Accessibility for accessible (above) and inaccessible (below) conditions.



Procedure

Data were collected during a lecture, entitled "Disability and Assessment," in both Japan and New Zealand. After a brief lecture on the topic of disability sports, which was not directly related to the nature of the current study, the study was introduced with an explanation of the ethical approval procedure and the right not to participate. Then we distributed a survey form to individual

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students. As part of the learning activity in the lecture, students were asked to view the 60 slides of the ECDA on the screen and to respond on a survey form on which the four-point Likert scale was printed.

Data analysis

To determine the internal consistency of the scale Cronbach's alphas were computed for both the New Zealand and the Japanese samples. An acceptable criterion for Cronbach's alpha was set at .70 or higher (Nunnally & Bernstein, 1994).

To assess construct validity, we performed exploratory factor analyses (EFA) with IBM SPSS Statistics Version. 22.0, following a guideline (Pasaogullari & Doratli, 2004). First, our sampling adequacy and the confirmation of the non-identity matrix were assessed with the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity respectively. Because we assumed that all items and emerging factors, which were designed to measure the helping intention of participants to aid people with impairments, would be highly correlated, a promax (oblique) rotation was used with a principal axis factoring method of extraction. Only factors with a minimum Eigenvalue of 1.0 or more were considered. To find the optimal number of factors, we followed the Minimum Average Partial test method (Velicer, 1976). Discriminant validity was investigated by inspecting factor correlations. A correlation between factors that exceeded .70 (49% shared variance) was considered to be too high because it lacked sufficient discriminant validity between the factors.

To assess the validity of the factor structures suggested by EFA, we planned to perform confirmatory factor analyses (CFA), using IBM SPSS AMOS 24. We assessed normality for CFA by paying attention to kurtosis and skewness of the datasets from Japan and New Zealand as recommended by Byrne (2010).

Results

Reliability

Internal consistency

Reliability estimation indicated the ECDA measure as a whole was sufficiently reliable in the Japanese sample (α = .955) and the New Zealand sample (α = .925). Likewise, split-half reliability for accessible items (n = 30) and inaccessible items (n = 30) demonstrated similarly high reliability in the New Zealand sample (α = .875; .918) and in the Japanese sample (α = .935; .948).

Validity

Exploratory factor analysis of 60 items

The sufficiency of our sample size was confirmed by the KMO, which yielded .67 for the New Zealand sample, and .85 for the Japanese sample. Both samples' statistics exceeded the minimum standard of .50 - .60 (Netemeyer, Bearden, & Sharma, 2003). Further, Bartlett's test of sphericity provided significant chi-square values of 3,625 ($p < .001$) for the New Zealand sample, and 5,107 ($p < .001$) for the Japanese sample. Thus, our samples met the two prerequisites for exploratory factor analysis (EFA).

We performed EFA using principal axis factoring with a promax rotation with the New Zealand and the Japanese data sets independently. Our a priori assumption was that the 60 items would generate a two-factor solution of 30 accessible items and 30 inaccessible items. Solutions for two, three, four, and five factors were individually examined in the factor loading matrix. The four-factor solution was preferred in both the New Zealand and the Japanese datasets because of (1) its previous theoretical support; (2) the 'leveling off' after four factors on the scree plots; and (3) the insufficient number of primary loadings and difficulty of interpreting the fifth and subsequent factors. The four-factor solution accounted for 49.46 % of the total variance in the Japanese sample and 39.53 % of the total variance in the New Zealand sample. The factor loading matrix and factor correlation matrix for the Japanese and the New Zealand samples are listed in

Appendix 1 and Appendix 2 respectively. Of the 60 items, 32 items were loaded on the same four factors in the Japanese and New Zealand samples, and 25 items were loaded on the same first two factors. The factor correlations were low ($r < .70$), indicating adequate discriminant validity for the four factors in both samples.

Exploratory factor analysis of 32 items common to all four factors

With the assumption that the 32 items would load on the same four factors in both samples, we performed EFA using principal axis factoring with a promax rotation with both nations' data sets independently. Solutions for two, three, four, and five factors were individually examined in the factor loading matrix. None of the factor solutions provided a strong fit.

Exploratory factor analysis of the 25 items common to both samples

We selected only the common items from Factor 1 and Factor 2 with the assumption that the 25 items would load on the same two factors in both samples, and performed EFA using principal axis factoring with a promax rotation with both nations' data sets independently. We examined solutions for two, three, and four factors in the factor loading matrix, and the two-factor solution demonstrated the fit, as shown in Appendix 3 and 4. The two-factor solution accounted for 48.76 % of the total variance in the Japanese sample and 41.46 % of the total variance in the New Zealand sample. The factor correlation was low ($r < .70$), indicating adequate discriminant validity for the two factors in both samples. Note that Item 26 in the New Zealand sample loads on both Factor 1 and Factor 2. Therefore, this item should be excluded in confirmatory factor analysis.

Confirmatory factor analyses

Although we wanted to perform confirmatory factor analysis for a two-factor model of the 24 items without Item 26, the tests for normality and outliers in IBM SPSS AMOS 24 indicated that our datasets from Japan and New Zealand violated the normality assumption in terms of a multivariate normal distribution (Critical Ratio > 5.00) (Byrne, 2010). Therefore, it was inappropriate to perform confirmatory factor analysis based on usual Maximum Likelihood (ML) estimation.

Because the sample sizes were less than 1,000, we were unable to base our analyses on asymptotic distribution-free (ADF) estimation (Byrne, 2010).

Discussion and conclusion

Existing tools for measuring attitude towards disability have not examined responsiveness to change and cross-cultural validity (Palad et al., 2016). To assess intervention effect in future research, we have developed a 60-item inventory named the Empathic Concern for Disability and Accessibility (ECDA) in Japanese and English languages to specifically assess prosocial attitude towards people with mobility and visual impairments who are either disabled or not disabled in inaccessible and accessible environments respectively. Initial ECDA pilot testing provided preliminary support for the instrument's reliability, construct and discriminant validity in Japan and New Zealand.

The ECDA evidenced a high internal consistency in both New Zealand and Japanese samples. Exploratory factor analyses (EFA) of both samples revealed four-factor solutions. The four extracted factors for both samples were characterised as Factor 1: obvious inaccessible situations; Factor 2: obvious accessible situations; Factor 3: complex inaccessible situations; Factor 4: complex accessible situations. The items included in each factor showed some difference between the two samples. Thus, items loaded with greater explanatory power on four factors rather than the hypothesised two factors. Lee J. Cronbach and Paul E. Meehl, the pioneers who introduced content validity stated that "Construct validation is involved whenever a test is to be interpreted as a measure of some attribute or quality which is not operationally defined. The problem faced by the investigator is, 'What constructs account for variance in test performance?'" (Cronbach & Meehl, 1955). The EFA of the 60 items revealed additional factors related to the complex quality of situations, and we labelled them as complex accessible and inaccessible situations. All factor correlations were low ($r < .70$) in both samples, demonstrating good discriminant validity and different qualities of helping intentions for accessible vs. inaccessible, and obvious vs. complex situations. Because the items contained in each of the four factors partially differed between the samples, the 60-item ECDA as a whole is not cross-culturally valid in its construct. However, the 25 items common to Factor 1 and Factor 2 in both samples demonstrated cross-cultural construct validity. In fact, Item 26 loaded on both factors in the New Zealand sample. Therefore, the 24 items, excluding Item 26, have the best cross-cultural construct validity. The two factor correlation was low ($r < .70$) in both samples, demonstrating good discriminant validity and different qualities of helping intentions between accessible and inaccessible situations.

Just because the 24 items seem to have the best cross-cultural construct validity, it does not necessarily mean that it would suffice to administer only those 24 items. It is noteworthy that the 24 items were not administered independently, but as part of the 60 items in our study. Because of the likely impact of presentation order (Schwarz & Hippler, 2004), the response from our pilot samples could have differed if only the 24 items had been administered to participants. A follow-up study needs to examine the usefulness of the 24 items alone as compared to the full 60-item version of the ECDA.

In a further application, the ECDA may be used to identify neuronal networks involved in prosocial attitude towards disability. In block design functional magnetic resonance imaging (fMRI) studies, an equal number of stimuli for contrasting conditions, such as accessible vs. inaccessible conditions, are required (Maus, van Breukelen, Goebel, & Berger, 2010). If the 60-item ECDA is used for such a purpose, the categorization of each item must be determined not from our initial categories of accessible and inaccessible situations, but from the accessible and inaccessible factors from the four-factor solution which demonstrated the perceptions of the ECDA slides in each sample.

Despite these preliminary findings that the ECDA has high internal consistency and adequate construct validity, the present study has limitations to be addressed. First, the distribution of data for individual items deviated from normality of skewness and kurtosis. The distributions of the accessible items were theoretically expected to be positively skewed, the distributions of the inaccessible items negatively skewed, and all items were theoretically expected to be leptokurtic. Whereas all distributions of the 60 items were within the acceptable range of skewness < 3 and kurtosis < 10 (Kline, 2011) for the Japanese data, several of the 60 items were outside the acceptable range for the New Zealand data. Although we attempted to apply various mathematical transformations to normalise those items, our attempts were unsuccessful. We were also unable to perform confirmatory factor analysis because our datasets violated the assumption of multivariate normal distributions (Byrne, 2010). Thus, the construct validity of the ECDA is limited to our verification by exploratory factor analyses conducted, with a violation of the assumption of normality in the New Zealand sample.

Our study is also limited to two groups of undergraduate students in the largest physical education and sport science departments of universities in each country. In that sense, they may be regarded as "representative" physical education and sport science students, but our findings may not be generalised to all university students in each country because students studying other majors could be different in their prosocial attitude towards disability. The fact that the data collection took place during the lectures of the first two authors also poses a potential acquiescence response bias (Lavrakas, 2008).

To further examine the psychometric properties of the ECDA, future studies should examine criterion-referenced validity and sensitivity to change with a representative sample of university students who are not taught by the researchers. To establish convergent validity this inventory needs to demonstrate significant correlations with the existing measurement tools of attitude towards disability, such as those identified by recent systematic (Lam et al., 2010) and scoping reviews (Palad et al., 2016), and also with more extensive, already established empathy and altruism scales, such as the Interpersonal Reactivity Index (Davis, 1983) and the Self-Report Altruism Scale (Rushton, Chrisjohn, & Fekken, 1981). Sensitivity to change as a result of intervention, such as empathy priming, (Barlińska, Szuster, & Winiewski, 2015) meditation on compassion (Salzberg, 1995), disability training and education (Mulligan et al., 2016; Myers, 2009; Stachura & Garven, 2007) may be investigated by administering the ECDA to university students in Japan and New Zealand before and after intervention. After the disability training and education, the students should be less empathic and willing to help in accessible conditions, and more so in inaccessible condition by learning when to help and when not to, respecting independency. A context-specific scale like the ECDA could be useful for developing evidence-based strategies to educate university students.

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Appendices

Appendix 1. Factor loadings from exploratory factor analysis of Japanese sample (N = 129)

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
26	A wheelchair user is trying to wash their hands. There is no space under the basin for the wheelchair.	**.858**	.046	.184	-.198
34	A child in a wheelchair wants to play in the park not designed for wheelchair users.	**.814**	-.180	.066	-.176
16	A wheelchair user is trying to use a library computer. All computers are too high to access from wheelchairs.	**.774**	-.028	.005	-.031
31	A wheelchair user cannot use the escalator.	**.700**	.123	.030	-.254
58	A blind person is walking down the footpath. The overhanging branches are in the way.	**.697**	.029	.125	-.111
56	A person with visual impairment has a difficulty recognising low contrast objects in the room.	**.690**	.014	.098	-.040

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
52	A blind person is walking. The long cane misses the barriers.	**.690**	.033	.084	-.135
54	A blind person is walking, and unaware of the car parked across the footpath.	**.666**	.237	-.295	-.045
47	A wheelchair user is trying to enter the bathroom. There are steps.	**.656**	-.001	-.201	.110
20	A wheelchair user is trying to drink water. The standing fountain is too high and inaccessible.	**.645**	.075	-.030	.097
60	A partially sighted person is walking down the stairs. The tactile paving is broken, and the stairs are low contrast.	**.627**	.186	-.053	.036
43	A wheelchair user is wheeling up a steep slope.	**.606**	-.046	-.060	.089
36	A wheelchair user is shopping. The aisles are narrow and blocked with obstacles.	**.605**	.018	-.037	.186
40	A wheelchair user is trying to climb up to the upper floor.	**.578**	-.240	.113	.075

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
30	A wheelchair user is trying to enter the shop. The entrance is blocked by a clothing rack.	**.569**	.105	-.110	.058
50	A wheelchair user is on the nature walk. The path is muddy.	**.560**	.031	.033	.033
38	A wheelchair user is trying to climb up the stairs. There is no ramp.	**.548**	.020	-.117	.092
28	"A wheelchair user is trying to enter the shop. The entrance has steps.	**.508**	-.126	-.038	.262
41	A wheelchair user is trying to enter the building. There are stairs in front of the door.	**.473**	-.052	-.150	.406
46	A wheelchair user is trying to enter the apartment house. There is no ramp.	**.400**	.231	-.095	.247
23	A wheelchair user would like to eat at a café. There are wide spaces to get between the tables.	**.391**	.378	.270	-.309
8	A blind person is walking with a cane. The tactile paving is blocked by bikes.	**.374**	-.180	.012	.374

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
13	A wheelchair user is trying to move through the doorway. The door opens automatically.	-.194	**.885**	-.213	.075
15	A wheelchair user is trying to use a library computer. There is a lowered table accessible for wheelchair users.	.033	**.794**	-.069	-.219
9	A blind person is standing at the railway crossing. There is tactile paving on the crossing.	.115	**.750**	-.159	.149
7	A blind person is walking on the footpath with unobstructed tactile paving.	.197	**.683**	-.030	-.174
11	A wheelchair user is using a ramp to get to the building.	.002	**.649**	-.139	.271
29	A wheelchair user is trying to enter the shop. The automatic door is wide and free from obstacles.	-.211	**.575**	.347	-.016
19	A wheelchair user is trying to drink water. There is an accessible low fountain.	.188	**.518**	.253	-.285
27	A wheelchair user is trying to enter the shop. The entrance is wide and flat.	-.055	**.496**	.202	.087

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Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
21	A wheelchair user is trying to climb this gentle slope.	.230	**.443**	.114	-.019
18	A blind person is walking towards the exit following the tactile paving and there are no obstacles.	.034	**.435**	.252	.152
35	A wheelchair user is shopping. The aisles are wide and free from obstacles.	-.004	**.402**	.335	.113
25	A wheelchair user is trying to wash their hands. There is space under the basin for the wheelchair.	.141	**.386**	.362	-.117
32	A wheelchair user can use the lift.	.056	**.302**	.264	.164
57	A blind person is walking down the footpath. The branches from the tree are high and clear.	.022	-.161	**.866**	-.098
51	A blind person is walking. The pathway is clear from obstacles.	.013	-.203	**.768**	-.082
55	A person with visual impairment can recognise high contrast objects in the room.	-.023	-.078	**.732**	.046

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
49	A wheelchair user is on the nature walk. The pathway is flat and smooth.	-.166	.227	**.709**	-.080
59	A partially sighted person is walking down the stairs, assisted by tactile paving and the high contrast stairs.	-.030	-.008	**.648**	.040
53	A blind person is walking on the clear footpath.	.184	-.135	**.622**	.107
44	A wheelchair user is wheeling along a flat path.	-.296	.277	**.465**	.239
48	A wheelchair user is trying to enter the bathroom. There are no steps.	.030	.142	**.459**	.080
39	A wheelchair user is trying to climb up to the upper floor with the wheelchair lift.	-.221	.305	**.442**	.126
45	A wheelchair user is trying to enter the apartment house. There is a ramp leading to the deck.	-.009	.278	**.352**	.131
33	A child on a wheelchair is playing in the park designed for wheelchair users.	-.006	.287	**.334**	.177
1	A wheelchair user is trying to get a book from the high shelf.	-.119	-.069	.015	**.642**

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
22	A wheelchair user is trying to climb this fairly steep slope.	.254	-.217	.196	**.578**
14	A wheelchair user is trying to move through the doorway. The door is heavy to open.	.162	-.407	.128	**.572**
4	A blind person is selecting a destination floor. There is no Braille on the buttons	.013	.061	-.034	**.548**
5	A blind person is trying to walk across the pedestrian crossing. There is a car on the crossing.	.201	.148	-.112	**.543**
10	A blind person is trying to walk across the railway crossing. There is no tactile paving on the crossing.	.322	.114	-.147	**.515**
12	A wheelchair user is trying to climb up the stairs.	.329	-.241	.108	**.506**
2	A wheelchair user is trying to get a book from the top of the low shelves on the side.	-.246	.103	.102	**.498**

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
17	A blind person is walking on the footpath with tactile paving where a car is parked right next to it.	.275	.001	.137	**.476**
3	A blind person is selecting a destination floor by reading Braille.	-.042	.225	-.062	**.423**
6	A blind person is trying to walk across the pedestrian crossing. There is no tactile paving on the crossing.	.272	.156	.119	**.401**
37	A wheelchair user is trying to climb up the ramp. The ramp is between the stairs.	.215	.134	.215	**.322**

Factor correlations	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1				
Factor 2	.29			
Factor 3	.37	.57		
Factor 4	.56	.15	.35	

Appendix 2. Factor loadings from exploratory factor analysis of New Zealand sample (N = 104)

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
46	A wheelchair user is trying to enter the apartment house. There is no ramp.	**.790**	-.217	-.025	-.085
28	A wheelchair user is trying to enter the shop. The entrance has steps.	**.779**	-.133	-.019	-.074
40	A wheelchair user is trying to climb up to the upper floor.	**.760**	.135	-.291	-.162
38	A wheelchair user is trying to climb up the stairs. There is no ramp.	**.686**	.103	-.174	-.186
30	A wheelchair user is trying to enter the shop. The entrance is blocked by a clothing rack.	**.679**	-.031	.034	.014
41	A wheelchair user is trying to enter the building. There are stairs in front of the door.	**.679**	-.091	-.021	.005
34	A child in a wheelchair wants to play in the park not designed for wheelchair users.	**.679**	-.062	-.023	.129

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
24	A wheelchair user would like to eat at a café. There are narrow spaces to get between the tables.	**.647**	-.008	-.046	.027
43	A wheelchair user is wheeling up a steep slope.	**.586**	-.165	-.052	.146
47	A wheelchair user is trying to enter the bathroom. There are steps.	**.571**	.057	-.001	.043
54	A blind person is walking, and unaware of the car parked across the footpath.	**.561**	.125	-.003	.012
36	A wheelchair user is shopping. The aisles are narrow and blocked with obstacles.	**.544**	-.001	.033	.120
20	A wheelchair user is trying to drink water. The standing fountain is too high and inaccessible.	**.542**	.041	.289	-.004
31	A wheelchair user cannot use the escalator.	**.517**	.067	.040	-.029
58	A blind person is walking down the footpath. The overhanging branches are in the way.	**.476**	.124	.263	-.106

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
21	A wheelchair user is trying to climb this gentle slope.	**.445**	-.043	.063	.316
52	A blind person is walking. The long cane misses the barriers.	**.431**	-.112	-.017	.031
56	A person with visual impairment has a difficulty recognising low contrast objects in the room.	**.406**	-.030	.109	-.033
45	A wheelchair user is trying to enter the apartment house. There is a ramp leading to the deck.	**.397**	.306	-.106	-.023
22	A wheelchair user is trying to climb this fairly steep slope.	**.386**	-.151	.252	.142
50	A wheelchair user is on the nature walk. The path is muddy.	**.371**	-.040	.095	.311
26	A wheelchair user is trying to wash their hands. There is no space under the basin for the wheelchair.	**.362**	.272	.181	.108
60	A partially sighted person is walking down the stairs. The tactile paving is broken, and the stairs are low contrast.	**.335**	-.022	.285	-.050

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
37	A wheelchair user is trying to climb up the ramp. The ramp is between the stairs.	**.215**	.085	.002	.160
32	A wheelchair user can use the lift.	-.044	**.760**	-.098	-.123
35	A wheelchair user is shopping. The aisles are wide and free from obstacles.	-.077	**.685**	-.105	.046
51	A blind person is walking. The pathway is clear from obstacles.	-.019	**.638**	.072	-.136
44	A wheelchair user is wheeling along a flat path.	.002	**.631**	.042	-.035
39	A wheelchair user is trying to climb up to the upper floor with the wheelchair lift.	-.027	**.629**	-.007	.176
29	A wheelchair user is trying to enter the shop. The automatic door is wide and free from obstacles.	-.083	**.589**	-.025	.143

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
42	A wheelchair user is trying to enter the building. There is a ramp beside the stairs.	.181	**.575**	-.247	.169
49	A wheelchair user is on the nature walk. The pathway is flat and smooth.	-.057	**.536**	.101	-.147
48	A wheelchair user is trying to enter the bathroom. There are no steps.	-.085	**.518**	.080	.026
27	A wheelchair user is trying to enter the shop. The entrance is wide and flat.	-.103	**.487**	.057	.096
33	A child on a wheelchair is playing in the park designed for wheelchair users.	.108	**.439**	-.170	-.075
53	A blind person is walking on the clear footpath.	.020	**.411**	.384	-.110
55	A person with visual impairment can recognise high contrast objects in the room.	-.150	**.401**	.324	.150
59	A partially sighted person is walking down the stairs, assisted by tactile paving and the high contrast stairs.	-.016	**.385**	.230	.129

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
23	A wheelchair user would like to eat at a café. There are wide spaces to get between the tables.	.035	**.380**	-.098	.249
25	A wheelchair user is trying to wash their hands. There is space under the basin for the wheelchair.	-.067	**.301**	.298	.075
18	A blind person is walking towards the exit following the tactile paving and there are no obstacles.	.141	**.237**	.118	.202
6	A blind person is trying to walk across the pedestrian crossing. There is no tactile paving on the crossing.	-.062	-.093	**.745**	.026
8	A blind person is walking with a cane. The tactile paving is blocked by bikes.	-.141	-.012	**.584**	.162
10	A blind person is trying to walk across the railway crossing. There is no tactile paving on the crossing.	.146	.020	**.551**	-.301

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
14	A wheelchair user is trying to move through the doorway. The door is heavy to open.	-.079	-.029	**.525**	-.119
5	A blind person is trying to walk across the pedestrian crossing. There is a car on the crossing.	.144	-.008	**.493**	.013
17	A blind person is walking on the footpath with tactile paving where a car is parked right next to it.	.358	-.115	**.468**	.036
9	A blind person is standing at the railway crossing. There is tactile paving on the crossing.	-.042	.085	**.455**	.376
16	A wheelchair user is trying to use a library computer. All computers are too high to access from wheelchairs.	.237	.243	**.435**	-.099

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
1	A wheelchair user is trying to get a book from the high shelf.	.163	-.073	**.286**	.090
57	A blind person is walking down the footpath. The branches from the tree are high and clear.	-.036	.268	**.279**	-.013
13	A wheelchair user is trying to move through the doorway. The door opens automatically.	.077	.137	-.224	**.692**
7	A blind person is walking on the footpath with unobstructed tactile paving.	-.039	-.143	.328	**.552**
3	A wheelchair user is trying to move through the doorway. The door opens automatically.	.077	.137	-.224	**.692**
12	A blind person is walking on the footpath with unobstructed tactile paving.	-.039	-.143	.328	**.552**

Item number	Item description	Factor 1	Factor 2	Factor 3	Factor 4
11	A blind person is selecting a destination floor by reading Braille.	-.162	-.032	.076	**.538**
15	A wheelchair user is trying to climb up the stairs.	.174	.159	.383	**-.521**
19	A wheelchair user is using a ramp to get to the building.	.292	.065	-.020	**.424**
2	A wheelchair user is trying to use a library computer. There is a lowered table accessible for wheelchair users.	.145	.175	-.286	**.412**
7	A wheelchair user is trying to drink water. There is an accessible low fountain.	-.073	.277	-.057	**.386**

Factor correlations	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1				
Factor 2	.13			
Factor 3	.48	.28		
Factor 4	.24	.28	.34	

Appendix 3. Two factor solutions for the 25 items common to the Japanese sample (N = 129)

Item number	Factor 1	Factor 2
34	**.761**	-.133
47	**.758**	-.169
36	**.738**	-.002
41	**.732**	-.163
28	**.717**	-.181
26	**.711**	**.230**
43	**.688**	-.123
56	**.685**	.136
40	**.685**	-.168
20	**.637**	.168
60	**.632**	.200
58	**.628**	.196
54	**.622**	-.008

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Item number	Factor 1	Factor 2
38	**.622**	-.064
30	**.620**	.011
52	**.614**	.107
50	**.578**	.090
46	**.568**	.130
31	**.535**	.199
29	-.300	**.941**
27	-.087	**.769**
35	.019	**.765**
25	.033	**.724**
18	.075	**.670**
32	.144	**.523**

Note. Loading larger than .300 is marked in **bold**.

Factor correlations	Factor 1	Factor 2
Factor 1		
Factor 2	.36	

Appendix 4. Two factor solutions for the 25 items common to the New Zealand sample sample (N = 104)

Item number	Factor 1	Factor 2
46	**.789**	-.291
28	**.733**	-.203
34	**.727**	.035
30	**.726**	-.055
20	**.709**	.225
41	**.698**	-.192
40	**.617**	-.069
47	**.610**	.081
58	**.607**	.174
38	**.605**	-.112
36	**.602**	.102

Item number	Factor 1	Factor 2
43	**.601**	-.183
54	**.594**	.182
31	**.569**	.149
60	**.528**	.054
50	**.516**	.112
56	**.512**	.004
26	**.462**	.424
52	**.459**	-.097
29	-.078	**.711**
32	-.121	**.656**
35	-.144	**.653**
27	-.056	**.651**
25	.112	**.567**
18	.279	**.473**

Note. Loading larger than .300 is marked in **bold**.

Factor correlations	Factor 1	Factor 2
Factor 1		
Factor 2	.12	