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Abstract

The purpose of the study was to establish and quantify the minimal important change (MIC) value necessary to determine gains or losses in clinical reasoning during student fieldwork assignments as measured by the Self-Assessment of Clinical Reasoning in Occupational Therapy (SA-CROT). This multicenter prospective longitudinal study was conducted with students on their occupational therapy fieldwork in Japan. Two anchor-based methods were used to estimate the MIC values: a receiver operating characteristic-based method and a predictive modeling-based method. The MIC was adjusted based on the percentage of participants who exhibited improvement. Administered were the SA-CROT and the Global Rating of Change (GRC) scale as an anchor. A total of 111 students from 11 occupational therapy educational programs in Japan responded (response rate 29%). Overall, there was a significant difference ($p < .001$, effect size was $r = .80$) in SA-CROT before and after fieldwork, and 81% of students showed improvement in the GRC scale. The adjusted MIC value was 3.69, with 95% confidence interval of 2.29–4.97. This anchor-based, adjusted MIC value is the most reliable value to interpret the changes in SA-CROT before and after fieldwork. The SA-CROT's MIC value can be used as a cut-off point from a learner-centered perspective when considering educational methods and environments in fieldwork.

Keywords

Clinical reasoning, minimal important change, fieldwork, assessment

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ABSTRACT

The purpose of the study was to establish and quantify the minimal important change (MIC) value necessary to determine gains or losses in clinical reasoning during student fieldwork assignments as measured by the Self-Assessment of Clinical Reasoning in Occupational Therapy (SA-CROT). This multicenter prospective longitudinal study was conducted with students on their occupational therapy fieldwork in Japan. Two anchor-based methods were used to estimate the MIC values: a receiver operating characteristic-based method and a predictive modeling-based method. The MIC was adjusted based on the percentage of participants who exhibited improvement. Administered were the SA-CROT and the Global Rating of Change (GRC) scale as an anchor. A total of 111 students from 11 occupational therapy educational programs in Japan responded (response rate 29%). Overall, there was a significant difference ($p < .001$, effect size was $r = .80$) in SA-CROT before and after fieldwork, and 81% of students showed improvement in the GRC scale. The adjusted MIC value was 3.69, with 95% confidence interval of 2.29–4.97. This anchor-based, adjusted MIC value is the most reliable value to interpret the changes in SA-CROT before and after fieldwork. The SA-CROT's MIC value can be used as a cut-off point from a learner-centered perspective when considering educational methods and environments in fieldwork.

Introduction

Clinical reasoning (CR) is an essential topic in the education of health-related professions (Pinock & During, 2021; Young et al., 2020). In occupational therapy, CR is the process practitioners use to develop and provide occupational therapy services to individuals, groups, or populations (Schell & Benfield, 2023). Hence, learning CR from undergraduate education is essential (World Federation of Occupational Therapists [WFOT], 2016). Fieldwork and case-based experiential learning opportunities have been suggested to develop CR in occupational therapy students (Coker, 2010; Knecht-Sabres, 2010, 2013; Murphy & Stav, 2018; Rodríguez-Bailón et al., 2021; Scaffa & Wooster, 2004).

Practical learning of clinical reasoning for occupational therapy students requires self-assessment to obtain internal and external feedback on their clinical experiences (de Beer & Mårtensson, 2015; Maruyama et al., 2023; WFOT, 2016). Occupational therapy students need to learn the language of reasoning unique to occupational therapy to receive feedback, but verbalizing CR is difficult for even occupational therapy practitioners (Da Sliva Araujo et al., 2022; Fleming, 1994). Therefore, discussing fieldwork experiences to verbalize and using a case report format and a self-assessment of CR to modify thinking have also been suggested as necessary (Bowyer et al., 2019; Coker, 2010; Falk-Kessler & Ciaravino, 2006; Knecht-Sabres, 2010; Neistadt, 1998). Future work to build effective CR education includes quantifying CR self-assessment and change and developing and demonstrating effective educational methods (Márquez-Álvarez et al., 2019; Unsworth & Baker, 2016).

In a previous study, the Self-Assessment of Clinical Reflection and Reasoning (Royeen et al., 2000) and the Evidence-Informed Professional Thinking (Benfield & Johnston, 2020) were developed and examined for validity and reliability to be translated into quantitative scores. These assessment tools may not sufficiently reflect occupational therapy-specific CR processes such as narrative reasoning. The possible inadequacy is because these tools were developed based on reflection and evidence-based practice, and they cover CR for other professionals and students. On the other hand, there has been a trend to consider specific CR concepts for each profession (Huhn et al., 2019; Simmons, 2010; Yazdani & Abardeh, 2018). Gordon et al. (2022) recommended that when developing a CR assessment scale, it is necessary to clarify each profession's CR concept and ensure that assessment items appropriately reflect that concept.

The Self-Assessment of Clinical Reasoning in Occupational Therapy (SA-CROT) has proven to have the validity and reliability of scale (Maruyama et al., 2021b, 2022a, 2022b) required by the consensus-based standards for the selection of health measurement instruments (Mokkink et al., 2018). The SA-CROT is a self-assessment scale expressing occupational therapy students' and practitioners' CR skills as a continuous numerical value (Maruyama et al., 2022b). SA-CROT conceptual background is the CR concept in occupational therapy students and practitioners (Maruyama et al., 2021a), which was constructed by four thinking processes (i.e., scientific, narrative, ethical, and practical). Based on these results, items and rating stages of scale were created, and users and experts of occupational therapy education examined the content validity and usefulness of the prototype version of SA-CROT (Maruyama et al., 2021b, 2022a). The items of SA-CROT have been refined by confirming the goodness of fit to the Rasch measurement model (RMM) and confirming a differential item function (DIF). Also, test-retest reliability has been verified to ensure that it can be measured (Maruyama et al., 2022b).

Although SA-CROT facilitates the sharing of current CR learning progress between learners and educators in clinical education, there needs to be more information to interpret the meaning of change for individual learners and to determine appropriate educational approaches (Maruyama et al., 2022a). Fieldwork learning is considered an individual and dynamic process influenced by multiple factors (Grenier, 2015). Accordingly, it is necessary to establish methods to translate changes in student-centered subjective quantitative scores of assessments into qualitative meanings to make decisions for CR education in occupational therapy fieldwork. In response to the need to convert quantitative score changes into qualitative meaning, thus minimal important change (MIC) and minimal clinically important difference (MCID) have been estimated (Li & Lin, 2020; Ohno et al., 2021).

MIC is a method of making qualitative sense of changes in quantitative scores from the learner's perspective (Terwee et al., 2021). MIC is positioned as part of the interpretation of the scale (Mokkink et al., 2018). Terwee et al. (2021) defined the MIC as a threshold for a minimal significant within-person change over time above which clients perceive themselves as having experienced a change. In addition to being used as a threshold to indicate improvement, it can also be used as a probabilistic value for individual learner change (Terwee et al., 2021). Examining the MIC of the SA-CROT can allow for a more meaningful interpretation of learner change. However, the MIC value of the SA-CROT in fieldwork remains unknown, so a threshold that indicates improvement in CR from the learner's perspective is required to be established. Hence, this study aims to examine the interpretability of the SA-CROT by estimating the MIC value in before- and after-fieldwork for occupational therapy students.

Method

Study Design and Ethics

This multicenter prospective longitudinal study was conducted with students on their occupational therapy fieldwork in Japan. This study was conducted with the approval of the Research Ethics Review Committee of the affiliated research facility (approval number 22010). This study was registered with the University Hospital Medical Information Network (registration number: UMIN 000051036).

Participants

Considering Japan's occupational therapy educational course, participants were selected by quota sampling methods (Iliyasu & Etikan, 2021). The educational courses in Japan consist of diploma courses (55%) and bachelor's courses (45%) (Japan Association of Occupational Therapists [JAOT], 2023). Diploma courses at vocational schools focus on practical skills, while university bachelor's courses emphasize theory and liberal arts (Ministry of Education, Culture, Sports, Science and Technology, 2023).

The sample size for this study was established as 100 participants or more based on the recommended sample size for MIC studies (Devji et al., 2020; Terwee et al., 2021). Inclusion criteria were students who were (a) in the educational course of occupational therapists in Japan and (b) had experience in fieldwork to learn CR. Exclusion criteria were students whose on-site fieldwork was canceled.

Japanese fieldwork is generally conducted in three levels to meet the World Federation of Occupational Therapists' standard (WFOT, 2016). The first-level focuses on observing clinical settings as a first experience to learn the role and basic attitude of occupational therapists; the second-level focuses on learning the occupational therapy process up to evaluation and goal setting, the purpose includes understanding the clinical educator's CR; the third-level is a comprehensive fieldwork program that includes occupational therapy intervention and re-evaluation in addition to the content of the previous level (JAOT, 2019). Hence, the fieldwork in this study was at the second or third level. In Japan, if a replacement is required due to infection control measures, case exercises or on-campus fieldwork are conducted (Ministry of Health, Labour and Welfare, & Ministry of Education, Culture, Sports, Science and Technology, 2022). This study also includes cases where fieldwork was conducted on-campus due to coronavirus disease 2019 (COVID-19) pandemic restrictions.

Data Collection

The participants responded twice by web-based response form (Google Forms) within one week of the start and end of fieldwork. The contents of the survey consisted of (a) age, gender (female, male, no response), educational course (bachelor or diploma), fieldwork type (field only or combination of campus and field), level (second- or third-level) and duration, (b) SA-CROT as an assessment scale for CR, and (c) the Global Rating of Change (GRC) scale as an anchor for MIC value estimation. The survey period was from July 2022 to March 2023.

Self-Assessment of Clinical Reasoning in Occupational Therapy (SA-CROT)

The SA-CROT is a self-assessment scale comprising 14 items and five rating stages for occupational therapy students and occupational therapists (Maruyama et al., 2021b, 2022a, 2022b). The SA-CROT items (see Appendix) met the RMM assumptions; the eigenvalue indicating the scale's unidimensionality was 1.66, and the infit MnSq was less than 1.3. Also, the SA-CROT met adequate reliability; person separation reliability was 0.94, item separation reliability was 0.97, Cronbach's alpha coefficient was 0.93, and the intraclass correlation coefficient for test-retest reliability was 0.87 (Maruyama et al., 2022b). The five rating stages of SA-CROT are based on the revised version of Bloom's taxonomy (i.e., 1 = *unknown*, 2 = *attention/remembering*, 3 = *explaining/interpreting*, 4 = *applicating*, 5 = *analyzing*), criteria of RMM were met; the threshold difference was minimum 2.62 logit, maximum 4.06 logit, and the outfit mean-square (Outfit MnSq) was 0.96 to 1.08 (Maruyama et al., 2022b).

Global Rating of Change (GRC) Scale

Changes in student ratings are used as outcome measures to determine the effectiveness of specific interventions. Global Rating of Change (GRC) scales provide a method of obtaining this information in a manner that is quick, flexible, and efficient (Kamper et al., 2009). This study adopted the GRC scale as an anchor for CR changes before and after fieldwork. The GRC scale should be tailored to the needs of the respondents (Kamper et al., 2009). The content of the GRC scale was set to reflect the fieldwork learning achievement ("Under the guidance and supervision of a clinical educator, understand the clinical educator's CR and plan occupational therapy for typical clients") specified in the guidelines for occupational therapy fieldwork in Japan (JAOT, 2022). The degree of improvement/worse was measured using the GRC seven Likert scale (i.e., 1 = *much worse*, 2 = *worse*, 3 = *a little worse*, 4 = *no change*, 5 = *a little improve*, 6 = *improve*, 7 = *much improve*). The GRC scale was measured only at the post-assessment time points based on MIC studies recommendations (Terwee et al., 2021). This post-evaluation is also called the then test and is one of the methods to consider changes in self-assessment standards called response shift (Ortega-Gómez et al., 2022).

Statical Analysis

Descriptive Statistics and Distribution of Variation

The distribution of participants' characteristics and the GRC scale were calculated using descriptive statistics. The normal distribution of continuous variables was tested using the Kolmogorov-Smirnov test. Paired t-tests or Wilcoxon signed rank tests were used for differences in the SA-CROT before and after fieldwork. These tests were also used to determine the difference in the SA-CROT before and after fieldwork for each participant's characteristics (e.g., female, male, bachelor, diploma, only field).

Focusing on the amount of change on items in the SA-CROT, a comparison of differences by category of participant characteristics was performed (i.e., gender, educational course, fieldwork type, and fieldwork level). The Mann-Whitney U test was conducted to examine differences in the SA-CROT score changes by gender, educational course, fieldwork type, and fieldwork level. These results are presented as the effect size (ES) and the level of statistical significance set at $p < .05$ (two-tailed).

Estimation of MIC Value

There are two methods for the estimation of MIC value: distribution-based and anchor-based methods (Terluin et al., 2015; Terwee et al., 2021). In this study, two different anchor-based methods recommended by Terwee et al. (2021) were used to estimate MIC values: (a) receiver operating characteristic (ROC)-based method (MIC_{ROC}) and (b) predictive modeling-based method ($MIC_{predict}$). Thus, it is possible to determine the interpretation of the cut score that indicates the effectiveness of clinical reasoning learning in fieldwork. In this study, to estimate the MIC value of the SA-CROT improvement, this study included participants with an anchor GRC score of 4 (*no change*) or higher.

As a preliminary analysis to estimate anchor-based MIC values, we calculated correlation coefficients with 95% confidence intervals (CIs) for the change in the SA-CROT and anchors. This method examines whether the anchor is valid at the following MIC values. In this study, the standard value for the correlation coefficient was 0.30 or higher (Devji et al., 2020). Depending on the data distribution, the Pearson correlation coefficient or Spearman's rank correlation coefficient was used to analyze.

In the ROC method, sensitivity, specificity, and Youden index were calculated for the SA-CROT, whereby the Youden index = sensitivity + specificity − 1 (Youden, 1950). In the current study, the highest Youden index was considered to represent the optimal MIC_{ROC} value, which reflects the SA-CROT change score that provides the optimal distinction between 5 (*improved*) and 4 (*no change*). The area under the curve (AUC) for the ROC represents the probability that a student will be correctly identified by the SA-CROT as 5 (*improved*). The AUC value indicates a range from 0.5 to 1.0, and in this study, an AUC value of ≥ .90 was considered excellent, .80–.89 was good, .70–.79 was fair, and less than .70 was considered poor (Metz, 1978).

The predictive modeling method is based on the predicted probability that a participant belongs to the improvement group (based on the anchor) given the observed change points (Terluin et al., 2015). This approach utilizes a binary logistic regression analysis, with the group variable of improved/not-improved as dependent variable and the amount of change in the SA-CROT as the independent variable. The change score associated with a likelihood ratio of 1 is defined as $MIC_{predict}$ (Terluin et al., 2015). The accuracy and reliability of MIC_{ROC} and $MIC_{predict}$ may be affected if the improvement rate is below 50% (Terluin et al., 2017). To mitigate this issue, considering the adjusted $MIC_{predict}$ (MIC_{adjust}) was recommended by Terwee et al. (2021) and was therefore incorporated in this study.

At these cutoff points (i.e., MIC_{ROC}, $MIC_{predict}$, and MIC_{adjust}), accuracy, positive predictive value (PPV), negative predictive value (NPV), and F_1score were calculated. These were used as indicators (i.e., classification evaluation metrics) to examine the relationship between the measured and predicted MIC values (i.e., classification prediction results). Accuracy is the number of correctly classified samples divided by the total number of samples. The formula is accuracy = (true positives [TP] + true negatives [TN]) / (TP + TN + false positives [FP] + false negatives [FN]). PPV indicates the proportion of samples predicted to be in a positive class that is actually positive. The formula is PPV = TP / (TP + FP). NPV indicates the proportion of samples predicted to be in the negative class that are actually negative. The formula is NPV = TN / (TN + FN). The F_1Score is the harmonic mean of the detecting precision and recall of the positive class. F_1Score helps evaluate whether a classification model has a balanced performance. The formula is F_1Score = 2 (PPV × recall) / (PPV + recall). Recall indicates the percentage of samples that belong to the positive class that are actually correctly predicted as positive. The formula is recall = TP / (TP + FN).

Software and Packages

SPSS statistics version 26 was used as statistical analysis software for descriptive statistics, distribution of change, and correlation with anchor. R version 4.3.1 (R Foundation for Statistical Computing, Vienna, Austria), with the pROC package (Robin et al., 2011) and the lavaan package (Rosseel, 2012) were utilized to estimate the MIC value. Those described in the supplementary materials of Terwee et al. (2021) and Terluin et al. (2015) were used for the specific codes. The bootstrap method was used to calculate the estimated values and 95% CI of MIC_{ROC}, $MIC_{predict}$, and MIC_{adjust}.

Results

Participant Population and Distribution of Change Before and After Fieldwork

Survey request forms were distributed to 380 occupational therapy students, and 111 of them from 11 occupational therapy educational programs in Japan responded before and after their fieldwork (response rate = 29%). The average age of participants was 21.1 (standard deviation; SD = 2.2) years old, 59% female, 41% in bachelor's degree course, 80% in field-only, 49% in second-level fieldwork, and average fieldwork term 6 (SD = 2.5) weeks (see Table 1).

Table 1

Participant Characteristics

Characteristics	Category	*n = 111*
Age, *yr (SD)*		21.1 (2.2)
Gender, *n (%)*	Female	66 (59)
	Male	43 (39)
	No response	2 (2)
Educational course, *n (%)*	Bachelor	45 (41)
	Diploma	66 (59)
Fieldwork type, *n (%)*	Only field	89 (80)
	Campus and field	22 (20)
Fieldwork level *n (%)*	Second-level	54 (49)
	Third-level	57 (51)

Note. SD = standard deviation
The fieldwork average duration (SD) was 3.5 (0.7) weeks for the second level and 8.2 (0.9) weeks for the third level.

Comparing before and after fieldwork, the median before the fieldwork was 31.0 (interquartile range [IQR] = 24.0–38.8), and after the fieldwork was 42.0 (IQR = 32.5–48.5). The Wilcoxon signed-rank test results showed a significant difference ($p < .001$), with a large ES ($r = .80$). Regarding global change through fieldwork, 81% of participants showed improvement in the GRC scale, with 43% responding with 5 (*a little improve*), 35% responding 6 (*improve*), and 3% responding with 7 (*much improve*). On the other hand, 19% of participants indicated no improvement in the GRC scale. None of the participants responded with 1 (*much worse*) and 2 (*worse*), 6% responded with 3 (*a little worse*), and 13% responding with 4 (*no change*).

Table 2 displays the distribution of each category's score of the SA-CROT. For female participants, there was a median of 27.0 (IQR = 20.0–34.5) before fieldwork and a median of 39.0 (IQR = 30.5-45.0) after fieldwork, there was a significant difference ($p < .001$), with a large ES ($r = .81$). For males, there was a median of 30.0 (IQR = 24.5–39.5) before fieldwork and a median of 42.0 (IQR = 34.0–48.0) after fieldwork, there was a significant difference ($p < .001$), with a large ES ($r = .78$).

For the bachelor participants, there was a median of 25.0 (IQR = 19.0–28.0) before fieldwork and a median of 39.0 (IQR = 31.0–45.0) after fieldwork, there was a significant difference ($p < .001$), with a large ES ($r = .84$). For the diploma, there was a median of 36.0 (IQR = 30.0–41.8) before fieldwork and a median of 43.0 (IQR = 34.3–51.3) after fieldwork, there was a significant difference ($p < .001$), with a large ES ($r = .76$).

For the only field fieldwork, there was a median of 30.0 (IQR = 23.0–39.0) before fieldwork and a median of 42.0 (IQR = 32.0–49.0) after fieldwork, there was a significant difference ($p < .001$), with a large ES ($r = .81$). For the campus and field fieldwork, there was a median of 31.5 (IQR = 28.0–37.3) before fieldwork and a median of 41.0 (IQR = 33.5–47.5) after fieldwork, there was a significant difference ($p < .001$), with a large ES ($r = .73$).

For the second-level fieldwork, there was a median of 25.0 (IQR = 19.0–30.0) before fieldwork and a median of 36.0 (IQR = 30.3–43.0) after fieldwork, there was a significant difference ($p < .001$), with a large ES ($r = .81$). For the third-level fieldwork, there was a median of 38.0 (IQR = 32.0–42.0) before fieldwork and a median of 45.0 (IQR = 39.0–53.0) after fieldwork, there was a significant difference ($p < .001$), with a large ES ($r = .73$).

Focusing on the difference in the change due to the participant's characteristics, no difference was found in gender ($p = .961$). On the other hand, the bachelor's degree course was 14.0 (IQR = 7.0–22.0), and the diploma's degree course was 6.5 (IQR = 3.0–11.0), there was a significant difference in degree course levels ($p < .001$), with a medium ES ($r = .40$). A comparison of fieldwork type revealed no group differences ($p = .554$). On the other hand, the second-level fieldwork was 12.5 (IQR = 6.0–18.5), and the third-level fieldwork was 7.0 (IQR = 2.0–11.0), there was a significant difference in fieldwork levels ($p < .001$), with a medium ES ($r = .33$).

Table 2

Distribution of the Self-Assessment Clinical Reasoning in Occupational Therapy (SA-CROT) Before and After Fieldwork.

Characteristics	Category	*n* (%)	Before fieldwork	After fieldwork	Before vs. After	
			Median (IQR)	Median (IQR)	*P*-value	ES *(r)*
Gender	Female	66 (59)	27.0 (20.0–34.5)	39.0 (30.5–45.0)	< .001	.81
	Male	43 (39)	30.0 (24.5–39.5)	42.0 (34.0–48.0)	< .001	.78
	No response	2 (2)	36.0 (30.0–42.0)	47.0 (46.5–47.5)	-	-
Educational course	Bachelor	45 (41)	25.0 (19.0–28.0)	39.0 (31.0–45.0)	< .001	.84
	Diploma	66 (59)	36.0 (30.0–41.8)	43.0 (34.3–51.3)	< .001	.76
Fieldwork	Only field	89 (80)	30.0 (23.0–39.0)	42.0 (32.0–49.0)	< .001	.81
	Campus and field	22 (20)	31.5 (28.0–37.3)	41.0 (33.5–47.5)	.001	.73
	Second-level	54 (49)	25.0 (19.0–30.0)	36.0 (30.3–43.0)	< .001	.81
	Third-level	57 (51)	38.0 (32.0–42.0)	45.0 (39.0–53.0)	< .001	.73

Note. ES = effect size, GRC = global rating of change scale, IQR = interquartile range, SA-CROT = self-assessment scale of clinical reasoning in occupational therapy.

Estimation of MIC Value

Spearman's rank correlation coefficient was calculated to evaluate the strength of relationship between the SA-CROT and the GRC scale. The obtained Spearman's correlation coefficient was ρ = .799, 95% CI [.719, .857], indicating a strong positive correlation between the SA-CROT and the GRC scale.

As shown in Table 3, based on sensitivity .81 and specificity .86, MIC_{ROC} was 5.76, 95% CI [2.50, 8.50]. $MIC_{predict}$ was 5.78, 95% CI [4.62, 6.95]. Since 81% of the participants showed improvement by reporting 5 (*a little improve*), 6 (*improve*), and 7 (*much improve*) in GRC, as it was much over 50%, it was necessary to adjust the $MIC_{predict}$. $MIC_{predict}$ was adjusted to create MIC_{adjust}, the MIC_{adjust} was 3.69, 95% CI [2.29, 4.97], improving the accuracy (.82 to .87) and the F_1 score (.89 to .92).

Table 3

MIC Estimations and Model Performance of the Self-Assessment Clinical Reasoning in Occupational Therapy (SA-CROT)

	Estimate	95% CI	Classification evaluation metrics			
			Accuracy (%)	PPV (%)	NPV (%)	F_1 score (%)
MIC_{ROC}	5.76	[2.50, 8.50]	82	81	86	89
$MIC_{predict}$	5.78	[4.62, 6.95]	82	81	86	89
MIC_{adjust}	3.69	[2.29, 4.07]	87	89	71	92

Note. MIC = minimal important change, ROC = receiver operating characteristic, CI = confidence interval, accuracy = (true positives + true negatives) / (true positives + true negatives + false positives + false negatives), PPV = positive predictive value = true positive / (true positive + false positive), NPV = negative predictive value = true negative / (true negative + false negative), F_1score = 2 (PPV × recall) / (PPV + recall), recall = true positive / (true positive + false negative)

Discussion

Distribution of SA-CROT Score Changes in Fieldwork

This study showed significant changes ($p < .001$), with a large ES ($r = .80$) in SA-CROT before and after fieldwork, and 81% of learners reported global improvement. These results support the findings that experiential learning in fieldwork develops CR (Coker, 2010; Knecht-Sabres, 2010, 2013; Scaffa & Wooster, 2004).

Focusing on the difference in the change attributed to the participant's characteristics, there was no difference between genders. On the other hand, the SA-CROT changed more in the bachelor's degree course, and significant differences ($p < .001$, $r = .40$) were shown between the fieldwork levels. The reason for this might be the influence of the Japanese educational context. It is suggested that differences in the educational environment and learners' academic ability depending on the degree course may have influenced CR learning by promoting or inhibiting it, such as reflection during fieldwork and verbalizing CR (Maruyama et al., 2023). In a 2019 survey, 87% of Japanese educational programs offering a bachelor's degree also offer master's or doctoral courses (JAOT, 2023), and teachers of bachelor granting programs have a higher degree than diploma teachers. Thus, educational programs that offer a bachelor's degree tend to have instructors with a higher level of education than the programs that only offer a diploma. In the future, it is necessary to examine the possibility of CR learning based on the educational environment and detailed information of learners.

In addition, no differences were found between the fieldwork types regarding the amount of change. On the other hand, the SA-CROT changed more in the second-level fieldwork, and significant differences ($p < .001$, $r = .33$) were shown between the fieldwork levels. The reason for this difference in fieldwork level is that the second-level experience is the first opportunity for learners to learn about CR through on-site clinical experience (JAOT, 2022), and it is assumed that changes in CR are likely to be more profound than at the next level. In this study, due to uncontrollable factors caused by COVID-19, the type of fieldwork this time was divided into a field-only group and a combined on-campus and fieldwork group. No difference was observed between types of fieldwork because the new combined fieldwork method enhances learners' experiential learning and has a learning impact comparable to fieldwork alone (Gill et al., 2023). In 2022, when the data was collected, more than two years have passed since Japan was exposed to COVID-19 pandemic restrictions, and it is thought that each educational course has accumulated know-how using online and on-campus fieldwork (Miyadera et al., 2021; Miyamoto et al., 2021).

MIC of SA-CROT in Fieldwork

In this study, the MIC values of the SA-CROT were estimated by before and after fieldwork surveys. The following results were found (see Table 3), MIC_{ROC} was 5.76, $MIC_{predict}$ was 5.78, and MIC_{adjust} was 3.69. Based on the estimated value of MIC_{adjust}, if the amount of change in the SA-CROT during fieldwork is 3.69 or more, the data can be interpreted as a meaningful change. In other words, if the score is less than 3.69 points, the adjusted MIC value can be used suggests the need to consider modifications or changes to the educational method or environment.

This study adopted an anchor-based method using the GRC scale to estimate MIC. As a premise of the anchor-based method, a correlation with the GRC scale above a certain level is required (Devji et al., 2020). The Spearman's correlation coefficient of .799 observed here highlights the substantial association between the SA-CROT and the GRC scale. The strength of this correlation suggests that the SA-CROT can be a reliable indicator for predicting changes in the GRC scale. Moreover, the MIC values were estimated from 111 research participants. MIC estimation results for this study are reliable because this meets the recommendation of Devji et al. (2020) of 100 or more people.

Regarding the accuracy of MIC estimation, it has been pointed out that these results will be biased if the proportion of participants showing improvement is not 50% (Terluin et al., 2017; Terwee et al., 2021). In fieldwork, 81% of the students answered GRC 5 or higher. Thus, MIC_{adjust} was considered to correct for any bias in the results. As a result, MIC_{adjust} was fixed as a small value compared with other MIC values. As shown in Table 3, regarding the prediction performance of MIC values, the accuracy of MIC_{ROC} and $MIC_{predict}$ was .82, and the F_1Score was .89. On the other hand, MIC_{adjust} has the accuracy of .87 and the F_1Score of .92, indicating that it is a better prediction model than MIC_{ROC} and $MIC_{predict}$.

Limitations

Two significant limitations in this study could be addressed in future research. First, the response rate of this longitudinal study (29%) was equal to the SA-CROT test-retest reliability study (Maruyama et al., 2022b). This means that when interpreting the results, it is necessary to consider the possibility of selection bias regarding study participants, such as a bias toward highly motivated students. Finally, the MIC has been investigated in the Japanese version of SA-CROT. An international comparison of occupational therapy education suggests cultural factors influence student perceptions of change during fieldwork (Miyamoto et al., 2019). This point is relevant to considering the cross-cultural validity of scales when using and interpreting them (Mokkink et al., 2018).

Future Research

Improving the quality of pre-graduate education is an international research priority in occupational therapy (WFOT, 2021). Future research should involve international comparisons of SA-CROT MIC values to contribute to this goal. Therefore, future research should utilize the SA-CROT in international comparative studies, ensuring its cross-cultural validity.

Implications for Occupational Therapy Education

The MIC values of SA-CROT revealed in this study provide occupational therapy students, occupational therapy educators, and clinical educators with guidance in interpreting CR assessment results and making informed decisions about student learning. In other words, it adds to the perspective of a MIC as an individual learner when interpreting changes in SA-CROT before and after fieldwork. In addition, it can be used as a cut-off point from a learner-centered perspective when considering educational methods and environments in fieldwork.

Conclusion

This study adopted an anchor-based method and considered the proportion of participants who showed improvement (MIC_{adjust}) to provide a more accurate numerical estimate of MIC. The main finding of this study, the adjusted MIC value of 3.69 for the SA-CROT in fieldwork, has important implications. Adjusted MIC values can be interpreted as SA-CROT changes before and after fieldwork. Furthermore, it can be used as a cut-off point from a learner-centered perspective when considering educational methods and environments in fieldwork.

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Appendix

Items of the Self-Assessment Clinical Reasoning in Occupational Therapy (SA-CROT)

No.	Contents
1	Reasons for contents of occupational therapy goals
2	Evidence of an implementation of occupational therapy plans
3	Implementation planned by other occupational therapists
4	Predicting client changes due to occupational therapy
5	Clients' reactions in occupational therapy sessions
6	Occupations that the client wants to do and/or is expected to do by others
7	How engaged the client is in meaningful occupations
8	How the client and their family think about the future of their lives
9	Possible risks in clients' life situations
10	Senses and reflections in occupational therapy situations as therapists
11	How is the client-therapist therapeutic relationship
12	Reasons for selection of activities in occupational therapy sessions
13	Reasons for adjustments to the environment in occupational therapy sessions
14	What other profession's expertise is available

Note. The 14 items of SA-CROT were developed into a 40-item version through content validity studies and refined into a 14-item version through Rasch model analysis (Maruyama et al., 2022). The five rating stages of SA-CROT (i.e., 1 = unknown, 2 = attention/remembering, 3 = explaining/interpreting, 4 = applicating, 5 = analyzing) are based on the revised version of Bloom's taxonomy (Maruyama et al., 2021, 2022).

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