Developing a Framework for Assessing Transformative Competencies of Junior High School Students Through Construct Modelling Approach

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ABSTRACT

This research is designed to develop a comprehensive assessment framework to study junior high school students' transformative competencies in three dimensions: creating new value, reconciling tensions and dilemmas, and taking responsibility. Researchers developed and verified the quality of the assessment framework among the 120 junior high school students purposively selected from four schools in the northeastern and central regions of Thailand as the test-takers. The project is segmented into four phases: creation of the construct map, item design, outcome space, and Wright map. The framework's efficacy is analyzed using the Rasch model and the Maximum Likelihood Estimation method. Validity is rigorously evaluated through empirical evidence derived from the Wright map and cognitive interviews. Reliability is assessed via the standard error of measurement, test information function, expected-a-posteriori reliability, and Infit Mean Square value. Key findings included the development of a five-level construct map and the formulation of scaled open-ended questions based on the test takers' responses. A cut-off point is determined by dividing the threshold level by the number of tests at corresponding levels, adhering to Wright map criteria for each dimension. Subsequent item analysis and modeling confirmed the internal structure's validity and reliability. This framework equips them with skills to navigate and effectively

address complex real-world challenges, enhancing targeted educational strategies, promoting superior learning outcomes, and preparing students for advanced academic and professional environments.

Keywords: Assessment framework, construct modeling approach, junior high school students, Rasch model analysis, transformative competencies

INTRODUCTION

The Organization for Economic Cooperation and Development (OECD) has identified three dimensions of transformative competencies to empower students so that they can contribute, seek to shape well-being and a sustainable world, thus encounter the challenges of the 21st century as emphasized in the OECD Learning Compass 2030 (OECD, 2018). Hence, three transformative competencies are introduced: (1) creating new value, (2) reconciling tensions and dilemmas, and (3) taking responsibility. Creating a new value dimension is defined as the novel knowledge, insights, ideas, techniques, and strategies developments to create new jobs and innovate students to shape their better lives. When students create new value, they will enquire about the current situation, cooperate with others, and attempt to think out of the box. Next, the reconciling tensions and dilemmas dimension refers to students considering many interconnections and inter-relations between inconsistent or mismatched ideas, logics, and positions from both short- and long-term perspectives to obtain a greater understanding of contrasting situations, develop arguments to back their situation, and discover hands-on resolutions to solve the problems and conflicts. The final transformative competency dimension

is taking responsibility, which refers to the capability to replicate and estimate one's actions in light of one's practice and instruction after reflecting personal, ethical, and societal aims.

These transformative competencies go beyond traditional academic knowledge and foster personal development, social responsibility, and adaptability (Wolff, 2015). Some noticeable gaps in transformative competencies for junior high school students were identified in accordance with the OECD Future of Education Skills 2030 criteria, namely critical thinking and problem-solving (Halpern & Dunn, 2021), communication skills (Al-Alawneh et al., 2019), digital literacy (Yazon et al., 2019), and creativity and innovation (Anaktototy et al., 2023). According to Halpern and Dunn (2021), it is essential for junior high school students to analyze information critically, think creatively, and solve complex problems. This competency enables them to approach challenges with a strategic mindset. In addition, Al-Alawneh et al. (2019) emphasized the importance of effective communication, which involves expressing ideas clearly and actively listening. Junior high school students should develop the ability to communicate with diverse audiences using various mediums. Moreover, Yazon et al. (2019) stated that

junior high school students need to be proficient in using digital tools responsibly. It includes information literacy, online safety, and adapting to new technologies. On top of that, Anaktototy et al. (2023) emphasized the importance of nurturing creativity that allows junior high school students to think outside the box, explore new ideas, and approach challenges with innovation. This transformative competency fosters an entrepreneurial spirit and adaptability.

Grayling (2017) stated that all three transformative competencies are higher-level competencies that assist students in steering across various circumstances and experiences. Therefore, transformative competencies can be applied across a wide range of settings, are accessible, and can be achieved throughout a lifetime. Laukonnen et al. (2018) supported it by emphasizing the uniqueness of transformative competencies to manage uncertainty, build innovative mindsets and principles, and behave efficiently and significantly, even when targets change and persist for the time being.

The above literature review revealed the significance of integrating these transformative competencies into junior high school curriculum and learning environment that can contribute to the holistic development of students, preparing them for the challenges and opportunities they will encounter in their future education and careers (Grayling, 2017). However, there are no standardized or widely recognized assessment frameworks specifically tailored for transformative competencies for junior high school students. Generally, past researchers focused on holistic development when considering transformative competencies for junior high school students. Besides critical thinking and problem-solving, communication skills, digital literacy, creativity and innovation, they also studied collaboration and teamwork, self-direction and initiative, cultural competence, ethical decision-making, resilience and emotional intelligence, global citizenship, environmental stewardship, and financial literacy.

In this line of reasoning, transformative competencies make students uniquely human. When researchers create an assessment framework for transformative competencies at the junior high school level, it is important to consider age-appropriate methodologies, such as project-based assessments, presentations, portfolios, and reflective journals. Additionally, involving teachers, parents, and students in the assessment process can provide a more comprehensive picture of students' development (OECD, n.d.). Since the three transformative competencies are urgently needed in society and become more diverse and more interdependent as they develop, an assessment framework to guarantee that junior high school students obtain the transformative competencies is essential and urgently needed. Therefore, this research intended to create a sound assessment framework to explore junior high school students' transformative competencies in three dimensions: (1) creating new value, (2) reconciling tensions and dilemmas, and

(3) taking responsibility. The research is well-timed and essential to determine the developmental process of an assessment framework. It can also deliver evidence of the quality assessment framework's validity and reliability in the real setting.

MATERIALS AND METHODS

Test Taker

A total of 120 junior high school students were purposively selected from four schools in the northeastern and central regions of Thailand to be the test-takers. The main intention of a purposive sampling method was to ensure that the selected test takers were logically assumed to be representative of a cross-section of the population after considering the following criteria. They vary in the levels of transformative competencies (low, moderate, high), their results in national and international scientific student assessments, different school sizes (small, medium, high), and school readiness.

Research Procedure

The researchers employed construct modeling that embedded the critical incident technique (CIT) and transformative competencies assessment when developing a framework for assessing transformative competencies of junior high school students (Wilson, 2005). Firstly, the researchers defined transformative competencies that they wanted to assess. These included creating new value (CNV), reconciling tensions and dilemmas (RTC), and taking responsibility (TRE). Secondly, the

researchers conducted a thorough literature review to identify existing frameworks and models related to transformative competencies assessment in the context of junior high school education. Thirdly, the researchers used CIT to identify specific events or critical incidents where students demonstrate transformative competencies by engaging teachers, students, and other stakeholders in identifying these incidents. Fourthly, the researchers developed specific assessment criteria based on the identified critical incidents aligned with the transformative competencies they wanted to measure. These criteria should guide the evaluation process.

A design-based research method that combines quantitative data (scores or ratings based on assessment criteria) and qualitative data (description of critical incidents) was adopted (Reeves, 2006; Vongvanich, 2020) with four consecutive steps to create the transformative competencies assessment framework. This integration helps provide a more comprehensive understanding of students' transformative competencies. The researchers started a survey to investigate the transformative competencies of junior high school students for developing an assessment framework. In this case, junior high school students were the target population for this survey. The researchers integrated CIT into the survey by incorporating questions that prompt students to recall and describe specific incidents where they demonstrated transformative competencies or encountered situations that required such competencies. It is followed by designing and creating a

transformative competency assessment tool prototype through a real-time automatic digital platform. At this step, the researchers decided on the assessment methods that would be used to measure the competencies. It included multiple-choice questions, scenario-based assessments, practical tasks, and a combination. In addition, the researchers also chose the technology stack for their digital platform, encompassing programming languages, frameworks, and tools.

Then, researchers piloted the innovative prototype to create the construct map in each competency to fit the actual context. Creating a construct map for each competency is essential in validating and refining the innovative prototype. The construct map outlines each competency's key dimensions, sub-skills, or knowledge areas. The researchers have to pilot the prototype and gather data that allows them

to tailor the competencies to the specific needs and challenges of the target context. A series of interactive cycles of testing and refinement of solutions in practice was implemented. Finally, researchers reflected, revised, and improved the developed prototype of the transformative competencies assessment tool, reported pieces of validity and reliability evidence, and proposed principles to enhance the development of the innovative prototype of the transformative competencies assessment framework. Figure 1 illustrates the research procedure.

Research Instruments

Researchers used two research instruments to conduct a survey: (1) a semi-structured interview protocol and (2) a transformative competencies assessment form. This semi-structured interview protocol was used systematically to examine, reflect, and
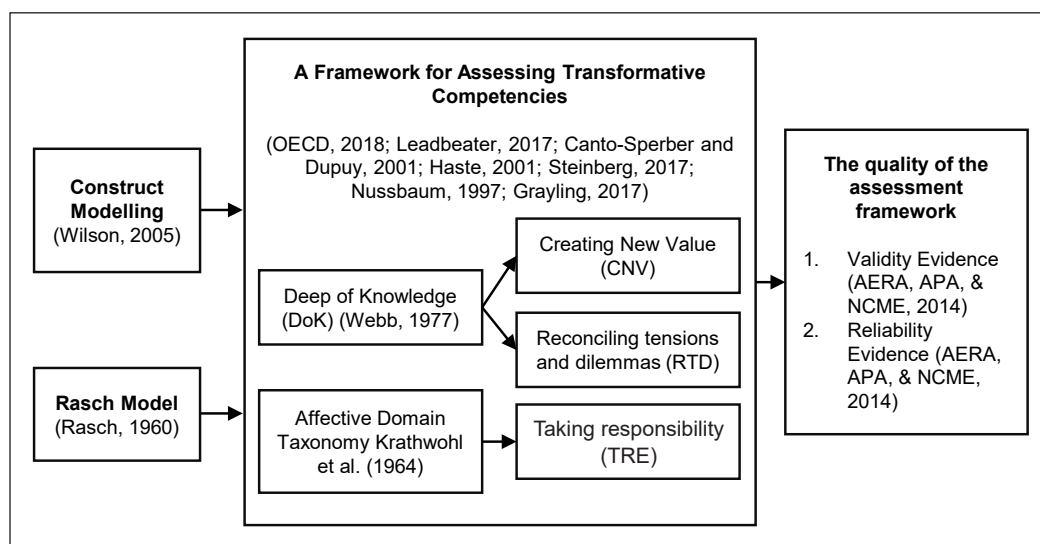

Figure 1. The research procedure
Source: Authors' work

learn from positive and negative aspects of transformative competencies employing the critical incident technique (Flanagan, 1954). The critical incident technique gathers incidents from less experienced users of the existing system to gain students' transformative competencies in dealing with critical incidents. Critical incidents are short descriptions of experiences that have particular meaning to the students. At the same time, the semi-structured interview protocol was used for students to reflect on their solutions based on the critical incidents. As a result, researchers could accurately interpret the characteristics of students' transformative competencies through interview transcriptions.

Another research instrument was the transformative competency form created from the semi-structured interview results using critical incident technique and reviewing related literature review. The researchers employed Mezirow's (2003) transformative learning theory to develop structured interview questions. Mezirow's theory explores how individuals can undergo profound shifts in perspective, beliefs, and behaviors through critical reflection and transformative learning experiences. There were 15 situations involving issues related directly to the students themselves, their families, school, and community. The transformative competency form consisted of six, four, and five items related to creating new value, reconciling tensions and dilemmas, and taking responsibility, respectively, using the Construct Modeling Approach (Wilson, 2005).

Even though the researchers employed alternative methods as valuable tools for assessing various transformative competencies for junior high school students, the researchers still have to be aware of some potential limitations, including assumption of unidimensionality, difficulty in measuring complex constructs, sensitivity to the test content, context sensitivity, assumption of invariance, limited diagnostic information, difficulty in assessing growth over time, and interpretability challenges. Therefore, when the researchers used the Rasch Model to assess transformative competencies, it was important to complement quantitative assessment with qualitative methods, such as interviews, portfolios, or observations, to better understand students' abilities and growth in transformative competencies. On top of that, the researchers should be cautious in interpreting and applying the results of the Rasch Model analysis after considering the above limitations in the context of transformative competencies for junior high school students.

RESULTS AND DISCUSSIONS

The Results of the First Phase

A preliminary study of the semi-structured interview results using the critical incident technique revealed that a test is the most effective tool to assess the quantity and quality of junior high school students' transformative competencies. Subsequently, researchers created the construct map consisting of four construct levels (under basic, basic, moderate, and advanced) for each dimension of transformative

competencies: (1) creating new value (CNV), (2) reconciling tensions and dilemmas (RTD), and (3) taking responsibility (TRE) to fit the actual context by adopting OECD framework for education 2030 (OECD, 2018).

Researchers used Webb's depth-of-knowledge (DOK) (Webb, 1997) to develop a practice and standards for scientifically evaluating the association between curriculum standards and assessments. It advances a model to evaluate the cognitive anticipation required by standards, curricular activities, and assessment tasks. As a result, every category of tasks (critical incident) indicates a distinct level of cognitive anticipation, or so-called depth of knowledge expected for the student to carry out the task or react appropriately according to each transformative competency dimension (CVN, RTD, and

TRE). However, researchers found some missing data or the answers inconsistent with the critical incident. Therefore, the researchers increased the lowest proficiency level to a No-relevance Level to cover all the students' answers from four to five levels for the three transformative competency dimensions, as shown in Figure 2.

The Results of the Second Phase

Researchers continued to design the tasks and items based on the results of the first phase to develop an open-ended situational measurement tool that aligned with the drafted assessment framework. The tasks or items were designed according to the construct map (Figure 2) of each transformative competency dimension as an open-ended situation that would lead to the feasibility of the corresponding answers to creating the descriptions of each
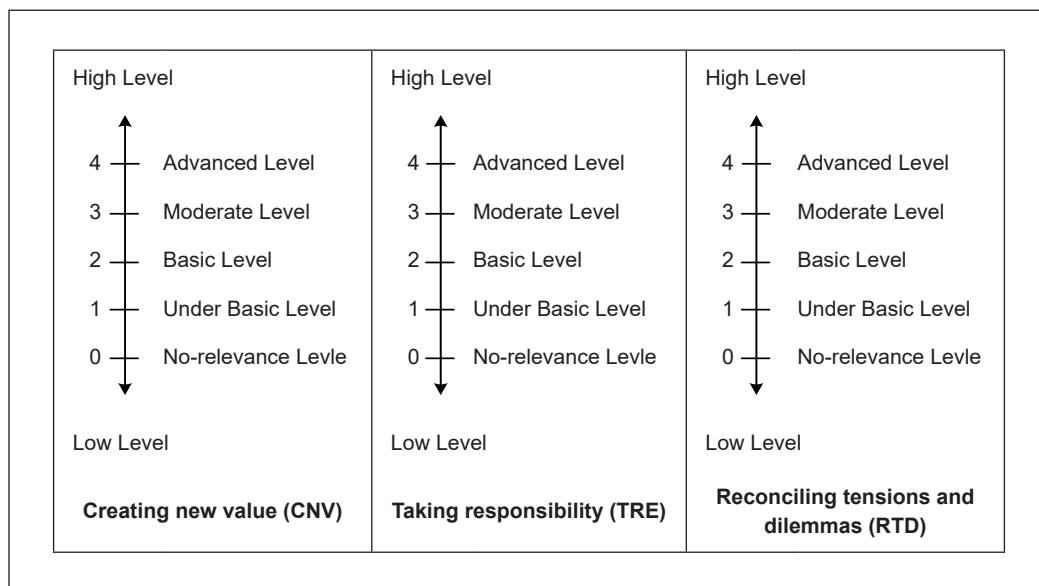

Figure 2. Construct map of transformative competency dimensions
Source: Authors' work

competency level for each dimension to develop an assessment framework. At the same time, researchers decided whether the results could be classified as transformative competency level. The decisions were made based on the assessment results at each level and whether they were consistent with the student's results in real conditions. Therefore, researchers conducted in-depth interviews with teachers and parents regarding the suitability of the created descriptions and the possibilities of using the task or item design as guidelines for scoring by considering the appropriateness of time-consuming.

Researchers followed it to determine the scope of contents and measurement of behavioral description for each dimension. As a result, the determinations were made not only based on the weight of the behavioral measurement but also on the transformative competency needs in each content of the dimension. Then, researchers created all the tasks as open-ended questions and measured them up to five levels, depending on the students' answers. In this line of reasoning, researchers characterized the transformative competency levels by investigating the students' methods in solving the given problem situations. For example, they solved the problems by themselves or with their friends to reduce the conflicts could be our main concerns. Figure 3 shows an example of task design to develop the drafted assessment framework.

Next, researchers interpreted the implication of every transformative competency level in every dimension in accordance with the learning consequence scaling or so-called outcome space. The outcome space was set to make sure students' responses in the actual context were in accordance with the construct map of learning consequences in the drafted assessment framework. Researchers began determining the scoring criteria for each dimension ranging from 0 to 4 points by employing the Partial Credit Model to compare and calibrate the items so that each item has an imagined location on the measured variable (Masters & Wright, 1997).

A total of 120 test takers participated in solving the problem situations in the drafted assessment framework from the second phase. Their test scores were checked using the created scoring guide or outcome space from the previous step. The results revealed five grades (Grade 1 to 5) with scores ranging

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Dimension   ☐   Creating new value
                       ☑   reconciling tensions and dilemmas
                       ☐   Taking Responsibility

Measurement Level 5 Advanced Level

Item 8 How do you do if political opinions do not match those of close friends, which may cause serious quarrels?

Figure 3. Examples of item design of RTD dimension
Source: Authors' work

from 0 to 4. The scoring scale was determined using Webb's depth-of-knowledge (Webb, 1997) concept. The interpretation for students who get the highest score at Level 5 is that they can solve the problem by cooperating with friends or even the opposing party. Although this method seemed to take a long time and require more patience, it worked well in solving the problems and benefited both parties. An example of outcome space for the RTD dimension is demonstrated in Table 1.

A transformative competencies assessment framework was finally developed to relate the latent traits of each dimension to the observed variables, as elucidated in Figure 4 and Table 2. Researchers counted the test-taker scores in each dimension item based on the Consecutive Unidimensional Model by the 3D composite as an ellipse showing latent traits and a square shape. A test blueprint was then created after demonstrating that a series of examinations in each dimension were conducted.

The Results of the Third Phase

The third phase of this research determines the cut-off point in assessing junior

Table 1
An example of outcome space for RTD dimension

| Level	Score	Definition	Example of Answers
Advanced	4	Can manage conflicts by collaborating and understanding between opposing parties.	Keep inserting content related to the problem by expressing their opinions to others.
		Listen to others' needs and communicate honestly with others.	Actively exchange ideas and listen to other opinions.
		Jointly brainstorm ideas for solutions that meet the needs of all parties based on creative problem-solving	Do not insult other opinions and understand the idea together.
Moderate	3	Can assess the situations that occurred in advance, both positive and negative.	Talk rationally to each other, accept, and do not interfere with other opinions or different thinking.
		Resolve conflicts through compromising by reducing their needs.	
		It may not be a good long-term solution to surrender some identities to fulfill the willingness of all.	
Basic	2	Identify and solve conflict situations by accommodating them regardless of other feelings or facts to resolve conflicts.	Inform others of the same opinions even though he/she does not agree with them.
Under Basic	1	Perceive the problem situation as conflict and solve it by avoiding it.	Do not talk about it again.
		; pressure others to accept their opinions through competition;	Although seeing others have different opinions is uncomfortable.
No-relevance	0	Do not answer	Do not answer or answer it unclearly.

Source: Authors' work
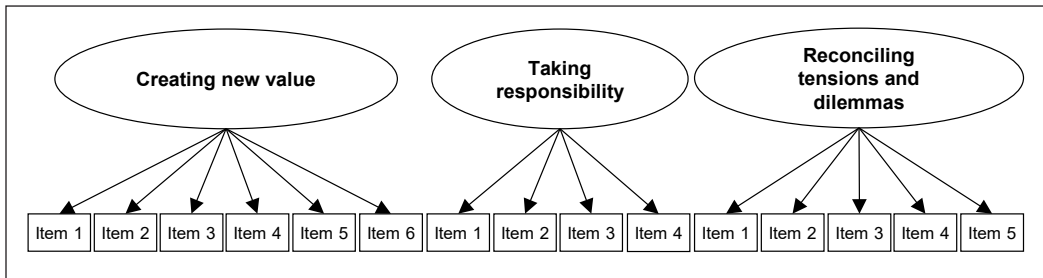
Figure 4. An assessment framework of transformative competencies
Source: Author's work

Table 2
Transformative competency assessment framework

Level	Score	TC Level	Creating new value (CNV)	Taking responsibility (TRE)	Reconciling tensions and dilemmas (RTD)
5	4	Advanced	Explain their reasons regarding the cause and problem solutions comprehensively for themselves and others. Connect knowledge and experience to think innovatively in various, systematic, and fluency methods. Collaborate with others to solve problems concretely and constructively.	They are responsible for their actions by adhering to moral and ethical principles and willingly respecting their and others' rights. Always consider the impact on the community Ready to apologize when making a mistake and correct it properly.	Manage conflicts by way of cooperation. Listen to and understand conflicting parties' needs. Communicate honestly with groups and jointly brainstorm ideas for solutions that can meet the needs of all parties based on creative problem-solving.
4	3	Moderate	Identifying the arising problems logically. Apply knowledge to create and develop solutions in a concrete and possible way.	Responsible for their actions, even if they contradict what they think. Must follow what is correct according to the norms of society.	Assess both positive and negative situations that may occur in advance.
3	2	Basic	Solve problems using common methods or imitate what has already been taught.	Take responsibility due to environmental pressure rather than feeling responsible for themselves.	Resolve conflicts using a compromise approach, as it involves finding a middle ground that accommodates the interests and concerns of all parties involved.
2	1	Under Basic	Solve problems involving straightforward approaches.	Show indifference to problems arising from their actions and do not show responsibility.	Resolve conflicts using an accommodated approach that involves giving in to the needs or desires of others while neglecting one's concerns.

Table 2 *(continue)*

Level	Score	TC Level	Creating new value (CNV)	Taking responsibility (TRE)	Reconciling tensions and dilemmas (RTD)
1	0	No-relevance	Do not answer questions. Ignore finding ways to solve problems.	No responsibility to find answers.	Resolve conflicts using an avoidance approach that involves sidestepping or postponing the resolution of a conflict.

Source: Author's work

high school students' transformative competencies. The intersections were determined by the threshold level divided by the number of tests at the same level for the three dimensions after considering each dimension's Wright map criteria area. Table 3 displays the results of calculating the intersection in each dimension to determine the transformative competencies assessment framework.

Table 3 shows the results of determining the cut-off point in assessing junior high school students' transformative competencies. The results revealed that the

Table 3
Results of determination of the cut-off point in assessing transformative competencies for junior high school students

Transformative Competencies	Item	Difficulty	Threshold 1	2	3	4
Creating New Value (CNV)	1	0.99	-4.60	-2.27	3.56	7.24
	2	1.45	-4.45	-1.48	4.67	7.05
	3	1.41	-4.66	-1.82	4.08	8.02
	4	0.56	-4.91	-2.08	2.89	6.36
	5	1.46	-3.05	-0.81	3.41	6.29
	6	1.63	-5.12	0.77	4.27	6.58
	Mean		-4.47	-1.28	3.81	6.92
Taking Responsibility (TRE)	1	0.75	-0.78	-0.23	0.79	3.16
	2	0.17	-2.57	-0.15	1.20	2.21
	3	-0.42	-2.55	-1.08	2.38	-
	4	0.34	-2.05	-0.05	1.26	2.65
	Mean		-1.99	-0.49	1.41	2.01
Reconciling tensions and dilemmas (RTD)	1	0.59	-2.23	-0.49	0.98	4.09
	2	0.65	-2.07	-0.38	0.97	4.09
	3	-0.44	-3.79	-1.02	0.48	2.56
	4	-2.12	-4.73	-1.52	-0.10	-
	5	-0.39	-4.06	-1.56	0.75	3.30
	Mean		-3.38	-0.99	0.62	2.81

Source: Authors' work

intersection in all three dimensions could be separated into four cut-off points into five levels in leading order. For instance, the cut-off points for creating new value dimensions were -4.47, -1.28, 3.81, and 6.92, respectively.

The Results of the Final Phase

The final phase of this research was to check the quality of the developed assessment framework of transformative competencies in terms of its validity and reliability using the ACER ConQuest (Version 5.29) program (Adams et al., 2020).

Results of Validity Evidence. The first validity evidence was analyzed by applying the Wright map. The validity reason of the Wright map is a graphical interpretation that connects the item difficulties and students' competency estimates on the normal scale as the quality evidence. According to Junpeng et al. (2020), Wright's map comprises a distribution of item difficulties, a distribution of student competency estimates, and how well the item difficulty distribution matches the students' competency estimates. Therefore, the items should match with the students' transformative competencies to justify that the assessment framework is maximally informative.

Results of the Wright map indicated that the distribution of item difficulties matches CNV and RTD dimensions well. Both dimensions show good variability in item difficulties or students' competency estimates. Figure 5 demonstrates the distribution of the test takers' transformative
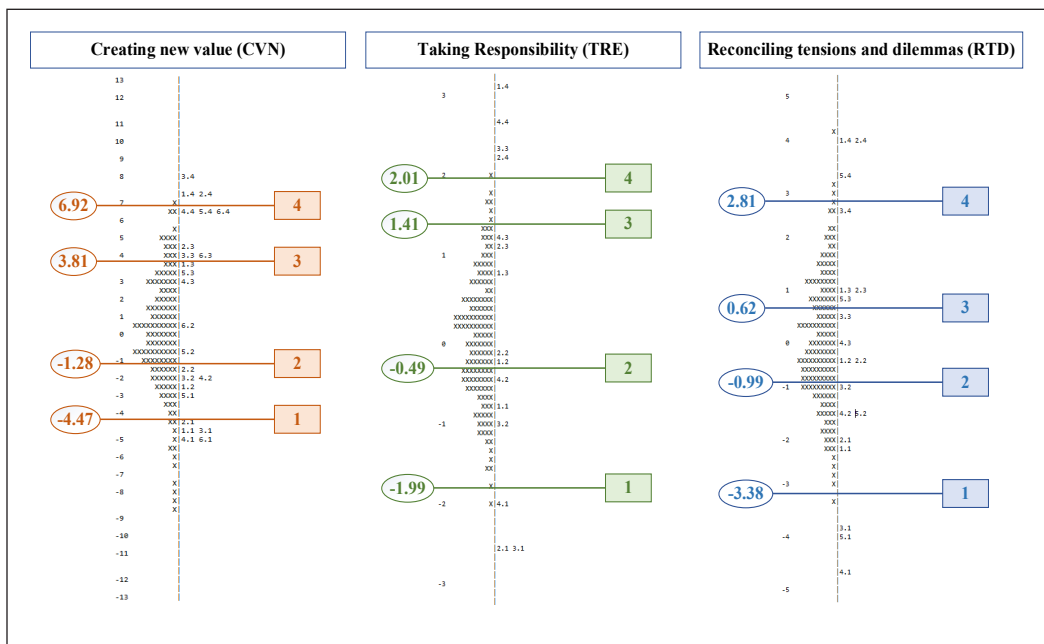

Figure 5. Wright Map to examine empirical evidence and items of assessment framework of transformative competencies
Source: Authors' work

competencies in CNV and RTD dimensions parameters (θ} covered all the related assessment items on the Wright map. For example, the CNV dimension has a spread value in the logit range of -9 to 8. This implies that the item design in the assessment framework covers all the competency levels. The same results were obtained for the RTD dimension.

However, the Wright map result of the TRE dimension revealed that the assessment item's difficulty level was inconsistent with the test takers' competency level with the parameters (θ} in the logit range -2 to +2. This implies that the generated assessment items cannot measure the test takers' transformative competency Level 1, that there is no answer, and that the problem situation is unrelated. Moreover, the selected test takers did not represent the students with the highest to lowest transformative competency level in the TRE dimension. This result parallels past studies (Baker & Kim, 2017; DeMars, 2010) as they emphasized the importance of selecting representative groups with various competency levels, especially for Level 1 and Level 5, and competency distribution should be in the logit -3 to +3.

The internal structural validity of the assessment framework considers the conformity of items, scoring, and intersection points that will determine the performance level in each dimension relative to the Wright map, along with the index. The results showed that the average of each item and the difficulty of each step from the answers appeared on the Wright map (Figure 4) above. On top of that, researchers found that all three dimensions consist of four intersection points, enabling the assessment framework to be set at five levels in each dimension. For example, the intersection points of the CNV dimension are -4.47, -1.28, 3.81, and 6.92, respectively. As Wilson (2005) and Junpeng et al. (2020) suggested, the assessment framework can be converted into scale scores or raw scores depending on the purpose of their implementation.

From the Wright map, researchers noticed that the minimum and maximum intersections of the TRE dimension are -1.99 and 2.01, respectively, where the intersection in the score ranges below -1.99 and above 2.01 used to assess the level of competence in Level 1 of the assessment framework. Nevertheless, the result showed no test taker with such characteristics. This implies that researchers have to consider the appropriateness of the assessment framework for the students in the real context. Therefore, there is a need to find additional groups at the level above. Moreover, researchers may need to adjust the description in the TRE dimension to be more relevant to junior high school students, especially at Level 5.

In addition, researchers considered the appropriateness of the scoring interval that the intersection should be collapsed Level 1 and Level 2 as reflected in the test thresholds. This indicates that some items cannot classify students' competency levels between Levels 1 and 2. Researchers modified the position of the intersection

point by adjusting the assessment level from five to four levels.

Moreover, the researchers considered whether the intersection should collapse the assessment standards at Levels 1 and 2 or modify the position of the intersection point by adjusting the assessment level from five to four levels. The results correspond to Kesorn et al. (2020), who examined the internal structural validity of the assessment framework. A combination of considerations is needed to confirm the internal structural elements showing the relationship between the traits and the assessment items, whether the model is a fit theory or an empirical model. The Rasch model is used in conjunction with consideration of the Wright map. In short, ensuring the measurement tool is consistent with the constructed framework, corresponds to actual conditions, and which parts should be amended is important.

The final strand of validity evidence was identified after researchers interviewed the test takers with different levels of transformative competencies using the CII technique. The interview results are then triangulated with the actual context of the test takers by interviewing their teachers and parents. Researchers aimed to assess their understanding of the contents and the relevancy of the items in the assessment framework. The interview results revealed that the characteristics were parallel with those of the students with different levels of transformative competencies. Therefore, the results align with those of Padilla and Leighton (2017), who investigated an appropriate method to verify the validity of the assessment framework using the cognitive interview method. Decrypting protocols as qualitative data is useful for describing each competency level and creating an assessment framework. Padila and Leighton (2017) utilized priority needs to determine the performance level from highest to lowest levels. The interview results revealed that students were found to possess characteristics similar to the actual context of their study.

Results of Reliability Evidence. Researchers used the standard deviation graph SEM (standard error of measurement) to assess the reliability of the developed transformative competencies assessment framework. When the assessment framework was separated into three dimensions, namely CNV (θ_{CNV}), TRE (θ_{TRE}), and RTD (θ_{RTD}), the latent parameter of each test taker would have a different SEM. Table 4 illustrates that the SEM of the three dimensions had mean scores close to 0 or equal to 0. It implies that the test takers' transformative competency levels are in a normal distribution. The results showed that the CNV dimension had a significantly wider range of competency level distribution compared to the other two dimensions, with θ_{CNV} in the range from -7.06 to 6.18. On the other hand, the TRE dimension had a significantly narrower range than the other two dimensions, with θ_{TRE} ranging from -1.51 to 1.64. The SEM for CNV, TRE, and RTD dimensions ranged from 0.68 to 1.14, 0.47 to 0.69, and 0.54 to 0.84, respectively. This implies that

Table 4
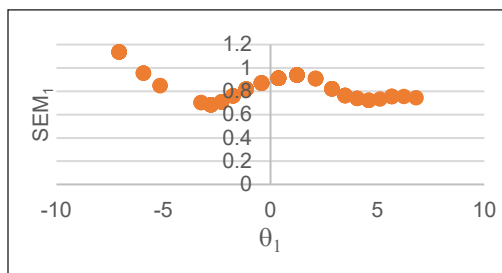*The standard error of measurement (SEM)*

	θ_{CNV}	SEM_{CNV}	θ_{TRE}	SEM_{TRE}	θ_{RTD}	SEM_{RTD}
Mean	-0.01	0.85	0.00	0.51	0.00	0.59
SD	3.15	0.11	0.66	0.02	1.22	0.06
Maximum	6.81	1.14	1.64	0.69	3.67	0.84
Minimum	-7.06	0.68	-1.51	0.47	-2.46	0.54
Range	-13.87	-0.46	-3.15	-0.22	-6.13	-0.30

Source: Author's work

the SEM values for the three dimensions are acceptable because there is a small error when estimating transformative competencies.

However, the SEM values for the three dimensions were acceptable, with a small error, and were more consistent in estimating the transformative competencies. It implies that the relationship between the location of the performance estimation in each dimension had the lowest error if students' transformative competencies (θ) were within the logits range. As a result, the reliability assessment results are stable and consistent. Figure 6 demonstrates the SEM results of CNV, TRE, and RTD dimensions.

Furthermore, the test information function in Figure 7 shows that test takers possessed moderate to low transformative competency dimensions. The results indicated that the transformative competencies assessment framework has the same characteristics as the test score (Figure 7). Therefore, it can be concluded that the transformative competencies assessment framework has to focus on test takers' proficiency levels before it is used to assess them. The maximum information was identified when the test takers were at the

(a)
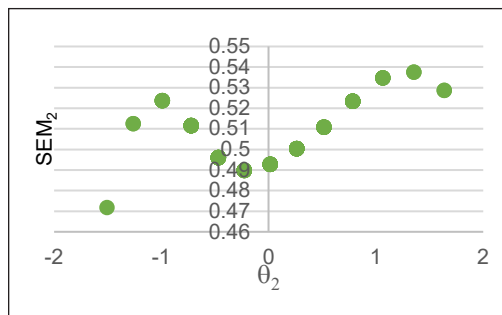
(b)
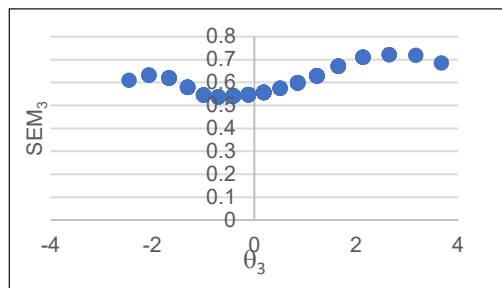
(c)

Figure 6. Standard Error of Measurement (SEM) of: (a) Creating New Value; (b) Taking Responsibility; and (c) Reconciliation Tensions and Dilemmas dimensions
Source: Authors' work

competency level 0 to the left. However, this tendency came towards low-performance levels, especially the CNV dimension, as the Test Information Function (TIF) is very high when estimating test takers with a performance level of -3, the position with the lowest SEM values.

The results of consideration from the Wright map, as shown in Figure 4, have important observations. The minimum and maximum intersections of the TRE dimensions were -1.99 and 2.01, respectively, where the intersection in the score ranges below -1.99 and above 2.01 were used to assess the level of competence in Level 1 of the assessment framework. The fact that no test takers have such characteristics reflects the need to consider whether the assessment framework is appropriate in the actual context. Researchers concluded that there is a need to find additional groups at the level above if the assessment framework is used. This implies that we have to adjust the description in the TRE dimension to be more relevant to the test takers at Level 5.

Researchers continued to examine the reliability coefficient indicated by expected-a-posteriori (EAP) reliability to check the consistency of the assessment framework with the Rasch model. The EAP reliability of CNV, TRE, and RTD dimensions were 0.91, 0.63, and 0.82, respectively, at the acceptable criteria (Adams, 2005). Moreover, the assessment framework has intrinsically consistent reliability (α) based on traditional testing theory because the EAP reliability of the assessment framework equals 0.85. is more

than 0.7 as the acceptance criteria (Adams, 2005). The final reliability evidence was determined by examining the suitability of each item of the assessment framework using the INFIT MNSQ value. The INFIT MNSQ value obtained from the assessment framework was 0.64 to 1.30, which fell at the acceptiable range between 0.75 to 1.33, as proposed by Adam and Khoo (1996) and Wilson et al. (2006). Therefore, researchers concluded that each item in the transformative competency assessment framework is suitable.
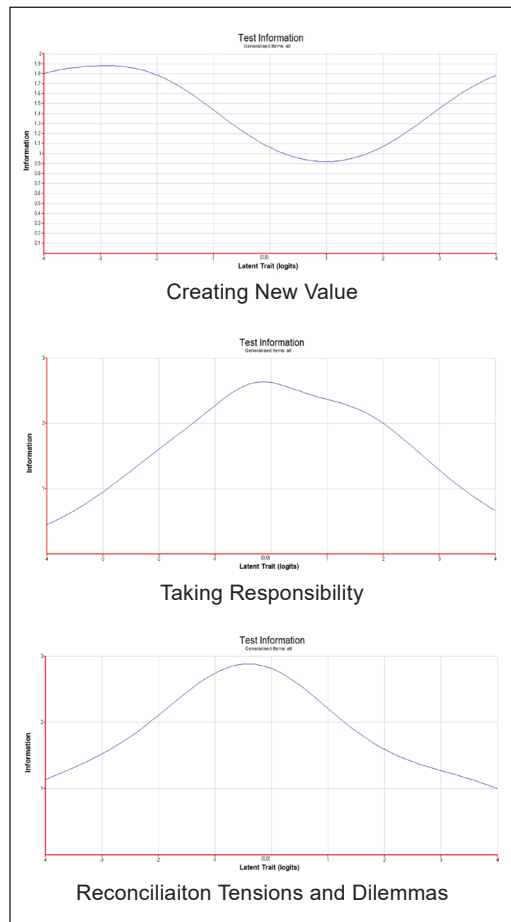

Figure 7. Test Information Function (TIF)
Source: Authors' work

The ultimate result of this research was successfully creating a transformative competency assessment framework for junior high school students after the researchers conducted a comprehensive measurement and evaluation. Therefore, the transformative competency assessment framework can have several implications, ranging from educational policy and curriculum development to teaching practices and student outcomes. It implies that the users of this transformative competency assessment framework must familiarize themselves with the existing criteria, including understanding the key dimensions, domains, and competencies the OECD has outlined for the Future of Education and Skills 2030 (OECD, 2018). Moreover, teachers must consider how these trends may impact the skills and knowledge that junior high school students will need in 2030 after anticipating future trends in technology, the economy, and society. It is to ensure that the criteria are forward-looking and can accommodate evolving demands.

CONCLUSION

The key result of this research is that an assessment framework of transformative competencies was developed aiming at measuring junior high school students' transformative competencies in three dimensions: (1) CNV, (2) RTD, and (3) TRE. Besides, the developed assessment framework is found to have acceptable levels of validity and reliability. It is considered a sound assessment framework because it has endured a thorough and methodical research procedure. Thus, this sound assessment framework can assess junior high school students' transformative competencies, particularly meeting the OECD Future of Education Skills 2030. Current educational institutions and researchers increasingly recognize the importance of fostering skills and competencies beyond traditional academic subjects. The results have connected to the overall objectives of this research to identify the knowledge, skills, attitudes, and values that students need to thrive in the future, which is aligned with the sustainable development goals of the United Nations (OECD, 2018) on how education can play a crucial role in achieving these goals and aligning the criteria that can enhance their relevance and impact.

In addition, the results of this research have successfully suggested a comprehensive and systematic approach to evaluating the transformative competencies of junior high school students. Since the core of this research revolved around creating a framework, the importance of having a structured framework for assessing transformative competencies has contributed to a more accurate and holistic evaluation of students (Grayling, 2017). On top of that, the assessment framework has defined what transformative competencies mean with CNV, TRE, and RTD in the context of junior high school students by elaborating on the skills and attributes that are considered transformative and essential for their personal and academic development (Mezirow, 2003).

Theoretical and Practical Implication

This research contributes to educational psychology by delving into the theoretical underpinnings of transformative competencies. It assists in expanding our understanding of psychological processes involved in developing competencies beyond traditional academic knowledge (Lohse-Bossenz et al., 2013). Moreover, using a construct modeling approach aligns with constructionist learning theories. This research may provide insights into how students construct their understanding and competencies, shedding light on the cognitive processes involved in transformative learning experiences (Zajda, 2021).

Furthermore, the assessment framework likely draws on holistic development theories that emphasize the multifaceted nature of a student's growth. Theoretical implications might involve discussions on how transformative competencies contribute to overall personal, social, and cognitive development during the crucial junior high school years (Stodden et al., 2023). Besides, the research touches upon theories related to the transferability of competencies across various domains. It could involve exploring whether the transformative competencies developed by junior high school students are applicable and beneficial in different academic subjects and real-life situations (Nägele & Stalder, 2017).

The main practical implication of this research is that the assessment framework has successfully contributed to the transformative competency-driven learning method in the education context. Transformative competencies development is defined as the ability of students to participate in solving problem situations that represent a combination of skills, strategies, and processes to the degree that they comprehend and can relate their knowledge to new settings, as reflected in the research results. The reported results are in line with Hipkins (2012), who states that transformative competencies should represent a much wider and more compliant accomplishment than a straightforward collection of skills in the 21st-century educational context. A spotlight on skills progress ignores other essential capabilities students need as lifelong learners. It can be concluded that transformative competencies are highly emphasized in the discourse exploring responses to mega-global trends such as the fourth industrial revolution. By acquiring transformative competencies, students will be well prepared to challenge complications with a practicable technique. It is the reason why the OECD 2030 learning framework aims to help students assess their transformative competencies so that it can guide them to outline the realm in 2030 by flourishing in a structurally excessive realm through coping with conflicts, contradictions, trade-offs, ambiguity, creating new value to the world, and taking responsibility to keep the world in balance (OECD, 2017).

The practical implication of this research is that the transformative competency assessment framework will likely influence curriculum development by shaping the content, learning objectives,

and activities included in the junior high school curriculum. As a result, high schools may need to revise existing curricula or develop new materials to align with the transformative competencies emphasized in the assessment framework, as Kesorn et al. (2020) suggested. On the other hand, teachers play a crucial role in facilitating would necessitate training and professional development programs for teachers. It may include workshops on instructional strategies, assessment methods, and incorporating transformative competency development into teaching practices, as Junpeng et al. (2020) recommended. Moreover, this assessment framework will impact the learning experiences of junior high school students. Teachers may need to design and implement activities that foster the development of transformative competencies, such as critical thinking, creativity, collaboration, and adaptability. Project-based learning, experiential activities, and interdisciplinary approaches may become more prevalent.

Limitations and Recommendations for Future Research

The assessment framework may be context-specific, and its generalizability to different educational settings or cultural contexts may be limited. Therefore, future researchers should ensure that the assessment framework considers diverse backgrounds and educational systems. This research used a construct modeling approach that relies heavily on the validity and reliability of the chosen competencies accurately

representing transformative abilities and that the assessment tools are reliable, which can be another limitation. Transformative competencies, in particular, are dynamic and may change over time. As a result, the assessment framework may not capture the evolving nature of competencies as students progress through junior high school.

Additionally, assessing transformative competencies may involve a level of subjectivity. It is essential to acknowledge and address potential biases in the assessment process, including those related to the perspectives of assessors and students. Last but not least, implementing a comprehensive assessment framework may require substantial resources, including time, funding, and trained personnel. Therefore, future researchers should consider the feasibility of the proposed framework in real-world educational settings.

Longitudinal studies are recommended to future researchers because longitudinal studies can track the development of transformative competencies over time. It could provide insights into how these competencies evolved during junior high school. Moreover, future researchers should validate the framework across different cultural and socio-economic contexts to ensure its applicability in diverse settings and enhance its generalizability. In conclusion, future researchers should consider adaptability and flexibility while designing an assessment framework for the evolving nature of education. It may involve incorporating mechanisms for updates and revisions based on ongoing

research and feedback from practitioners due to the dynamic field of education, and ongoing research and adaptation are crucial to creating effective frameworks that can truly capture and nurture transformative competencies in junior high school students.

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