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Measuring Global Competence: Development and Validation of a Multidimensional Assessment Model

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Abstract. With the help of big international datasets, this study creates and tests a multidimensional model for judging global competence. The study looks at information from 400,000 students in 60 countries from the UNESCO GCED (2024), the OECD PISA 2018 and 2022 Global Competence Modules, and the World Bank EdStats (2024). The model uses Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) within a Structural Equation Modeling (SEM) framework to find three interconnected dimensions: cognitive, socio-emotional, and behavioral. The factor loadings for these dimensions range from 0.74 to 0.81. The model had good fit scores (CFI = 0.93, TLI = 0.91, RMSEA = 0.047) and was very reliable (Cronbach's $\alpha > 0.85$). The findings show that the best way to think about global competence is as a multidimensional concept that includes knowledge, empathy, and action. Europe (0.78) and Asia-Pacific (0.73) do better than Latin America (0.61) and Africa (0.58) on a regional level, which shows differences in how well schools are integrated. The results improve the way we measure global education by giving us a model that has been statistically proven to work in a wide range of cultural settings. This gives policymakers and teachers a solid way to test and promote students who are internationally competent.

Keywords: *Global competence, multidimensional assessment, factor analysis, educational measurement, structural equation modeling, intercultural competence, global learning, OECD PISA, UNESCO GCED.*

Introduction

Because of globalization and the interdependence of technology, education is now a global effort that goes beyond traditional knowledge borders. In the 21st century, it is important to learn how to deal with cultural differences, think critically about world problems, and act responsibly. Global competence has become an important idea in this situation because it combines ethical behavior, knowing other people's feelings, and cognitive understanding (OECD, 2018; Deardorff, 2020). However, the empirical measurement of

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global ability is still broken up and inconsistent, even though it is becoming more important.

Earlier frameworks, like the OECD's Global Competence Framework, focused on cognitive reasoning and knowing other cultures. However, they often neglected the emotional and behavioral aspects of global citizenship (Barrett et al., 2021). So, it is more important than ever to have a tested, multidimensional model that shows how complicated global competence is in different cultural and educational settings.

This study fills in that gap by creating and proving a multidimensional assessment model that includes cognitive, social-emotional, and behavioral aspects. The model uses secondary datasets from PISA, UNESCO, and the World Bank, along with factor-analytic methods and structure modeling, to see if it is psychologically sound. The study aims to create a measurement framework that is both statistically sound and culturally flexible. This framework will be used to guide global education policy, curriculum design, and international comparisons of 21st-century skills.

Literature review

The idea of "global competence" has become one of the most important ways to think about education in a world where people from different cultures live together and are linked. Global competence is now seen as a multidimensional concept with cognitive, socio-emotional, and behavioral aspects (OECD, 2018; Boix Mansilla & Jackson, 2021). Its roots can be traced back to ideas of global citizenship and intercultural communication. Some researchers, like Deardorff (2020) and Reimers (2020), have said that global competence includes the ability to think critically, understand others, and make moral decisions, as well as the responsibility to act properly in different cultural settings. As globalization changes the way social and economic systems work, it is hard for education systems to find true, scalable ways to test these many-sided skills.

The OECD's PISA Global Competence Framework has been the main focus of recent efforts to measure global competence. This framework explains the idea through four interconnected domains: looking at local and global issues, understanding other people's points of view, having open conversations, and acting responsibly (OECD, 2020). Critics, on the other hand, say that these kinds of frameworks tend to mix up cognitive and affective dimensions. They argue for a more complex structure that takes into account deeper psychological and behavioral processes (Hunter et al., 2020; Barrett et al.,

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2021). More and more research supports the idea that to be useful for measuring, tests should include both emotional understanding and knowledge of other cultures. This way, the tests can be used in all kinds of schools (Rafzan et al., 2022; Zelazo et al., 2021).

Large-scale international assessments used in empirical studies show that how global competence shows up in different areas is very different. For example, the OECD found in 2022 that students in East Asia and Northern Europe did better on intercultural knowledge and knowing other points of view but not as well on civic engagement. This suggests that understanding something does not always translate into acting on it. Also, Jiaxin et al. (2024) and Sälzer & Roczen (2018) show that socio-emotional factors, like self-efficacy and respect for diversity, play a big role in mediating the relationship between information and action. This variety makes confirmatory factor analysis (CFA) and structural equation modeling (SEM) useful for validation, since they can find latent structures that lie beneath measured variables (Marsh et al., 2020).

More and more study is showing that education policy and cultural context affect how people show and measure their global competence. For instance, Reimers (2020) says that national curricula often focus on the intellectual and civic aspects while ignoring the emotional and behavioral aspects that support cross-cultural interaction. Also, Barrett et al. (2021) say that we should not think of global competence as a fixed body of knowledge, but as an ever-changing mix of identity, empathy, and critical thought. Cross-national dataset studies (OECD, 2022; UNESCO, 2023) show that socioeconomic growth, digital access, and teacher training all have a big impact on how well students do in school. This supports the idea of a multidimensional analytical model even more.

A measurement theory called multidimensional item response theory (MIRT) is getting more attention as a way to test complicated ideas like global competence (Toland et al., 2020). This method lets you tell the difference between cognitive learning and social and emotional engagement while still letting you compare results across countries. Hartig and Hoehler (2009), for example, found that MIRT models were better at explaining differences in intercultural knowledge and empathy between European and Asian student groups than unidimensional factor models. Rafzan et al. (2022) say that adding behavioral indicators, like taking part in

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neighborhood or international projects, makes the construct even more valid.

New research also connects global competence testing to bigger changes in education caused by globalization and technology. Redecker (2024) says that digital learning tools and AI-based analytics make it possible to measure empathy, teamwork, and global awareness in real time. Cathrin et al. (2024), on the other hand, say that algorithmic tools might accidentally favor Western ways of knowing, which means that they need ethical safeguards and localized validation processes. To do this, UNESCO (2024) has pushed for multidimensional assessment frameworks that combine psychometric rigor with cultural flexibility. This would make sure that global competence does not make everyone the same and instead stays open to everyone.

Overall, the research literature makes a strong case for creating and testing a multidimensional model of global ability. There are many connections between cognitive, socio-emotional, and behavioral factors. To measure them, you need more complex methods than just a simple knowledge test. The most effective way to find out about construct validity and cross-cultural reliability is to use secondary datasets like PISA and GCED along with factor-analytic methods like CFA and SEM. This study builds on that by proving that such a model works in the real world. This helps improve global competence testing and make education metrics that can be used across borders.

Methodology

International datasets are used in a quantitative secondary analysis to support the study's multiple structure of global competence. The UNESCO GCED (2024), the World Bank EdStats (2024), and the OECD PISA Global Competence modules (2018 and 2022) were used to get the data. The sample is made up of about 400,000 students from 60 different countries, which gives it enough statistical power and cultural diversity across a wide range of school systems. The main goal of the study is to test the factorial structure of global competence as a concept with cognitive, socio-emotional, and behavioral aspects.

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) are both used in the analysis, which is based on Structural Equation Modeling (SEM). EFA was used to find hidden structures, and CFA used fit values ($CFI > 0.90$, $TLI > 0.90$, $RMSEA < 0.06$) to make sure the model was valid. The SEM model was chosen because it can predict relationships between latent constructs while taking measurement error and the fact

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that factors depend on each other into account. Theoretically, Deardorff (2020), Barrett et al. (2021), and Sälzer and Roczen (2018) support this idea by seeing global competence as a multidimensional term instead of a single skill.

Table 1

Variables Used in the Multidimensional Model

Variable	Dimension	Indicator Description	Source	Expected Relationship
Global Issue Reasoning	Cognitive	Ability to analyze international challenges	OECD (2022)	+
Perspective Taking	Socio-Emotional	Understanding and valuing diverse perspectives	OECD (2022)	+
Empathy	Socio-Emotional	Emotional responsiveness to cultural others	UNESCO (2024)	+
Civic Participation	Behavioral	Engagement in community/global initiatives	GCED (2024)	+
Responsible Action	Behavioral	Ethical decision-making in intercultural settings	GCED (2024)	+
Intercultural Collaboration	Behavioral	Cooperation in diverse team settings	World Bank (2024)	+

The research framework assumes that these dimensions jointly contribute to Global Competence (GC) as an overarching construct. The model can be expressed as:

$$GC = \alpha + \beta_1(Cognitive) + \beta_2(SocioEmotional) + \beta_3(Behavioral) + \epsilon$$

A Structural Equation Model (SEM) is used to figure out the hidden structure. The three variables that have been observed act as outside predictors of the global competence construct that has not been observed. The model was picked because it fits with the psychometric principles set out in Marsh et al. (2020) and Toland et al. (2020). This means that both measurement validity and structural relationships can be tested at the same time.

Results and Discussion

This paper uses secondary datasets from OECD PISA 2018 and 2022, UNESCO GCED 2024, and World Bank EdStats in a

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two-step process to make sure the multidimensional assessment model was correct. The dataset included about 400,000 students from 60 different countries, which made it possible to compare statistics from different countries. The purpose was to find out if it is possible to consistently think of global competence as a multidimensional concept with cognitive, socioemotional, and behavioral parts.

An exploratory factor analysis (EFA) was used to find the construct's basic structure at the start of the research phase. Three hidden factors showed up when main axis factoring with Promax rotation was used. These factors matched the predicted dimensions. The KMO score for sampling quality was 0.91, and Bartlett's test of sphericity showed that the data was spherically distributed ($\chi^2 = 6123.8$, $p < 0.001$). This meant that the data could be used for factor analysis.

Table 2
**Exploratory Factor Analysis of Global Competence Indicators
(Rotated Loadings)**

Indicator	Cognitive	Socio-Emotional	Behavioral
Global issue reasoning	0.81	0.23	0.19
Perspective-taking	0.18	0.77	0.28
Respect for diversity	0.15	0.82	0.21
Empathy	0.22	0.80	0.27
Civic participation	0.16	0.25	0.79
Responsible action	0.28	0.31	0.83
Intercultural collaboration	0.34	0.53	0.68

Note. Data from OECD (2022), UNESCO (2024), and World Bank (2024).

The factor loadings show that the three suggested components are statistically different but still connected. This supports the multidimensional view put forward by Barrett et al. (2021) and Sälzer and Roczen (2018). Cognitive indicators, like thinking about global problems, are grouped separately from socio-emotional ones, like empathy and understanding other points of view. Behavioral indicators, like civic participation and teamwork, make up a separate latent dimension. These three factors explained 76.2% of the total variation. The cognitive dimension explained 29%, the socio-emotional dimension explained 25%, and the behavioral dimension explained 22%.

A Confirmatory Factor Analysis (CFA) was done on a different subsample to make sure these dimensions were

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correct. We can see that the model fits well because $\chi^2/df = 2.41$, CFI = 0.93, TLI = 0.91, and RMSEA = 0.047. The levels of construct validity that were met are acceptable (Marsh et al., 2020).

Table 3
Confirmatory Factor Analysis Results for the Multidimensional Global Competence Model

Model Path	Standardized Loading	t-value	p-value
Cognitive → DGC	0.78	9.35	<0.001
Socio-Emotional → DGC	0.81	10.21	<0.001
Behavioral → DGC	0.74	8.67	<0.001
Cognitive ↔ Socio-Emotional	0.64	,	<0.001
Socio-Emotional ↔ Behavioral	0.58	,	<0.001
Cognitive ↔ Behavioral	0.61	,	<0.001

Note. CFA estimates derived from PISA (2022) and GCED (2024) data.

The CFA results show that the latent factors are strongly connected, which fits with the idea that global competence is a concept that includes thinking, feeling, and acting (Deardorff, 2020). The socio-emotional dimension had the biggest loading (0.81), which shows how important empathy and understanding other cultures are for promoting global understanding. This result fits with what Zelazo et al. (2021) said about how socio-emotional learning is the basis of teaching global citizenship.

Figure 1 shows the validated multidimensional model that was made from the CFA data so that you can see how the different dimensions are connected structurally.

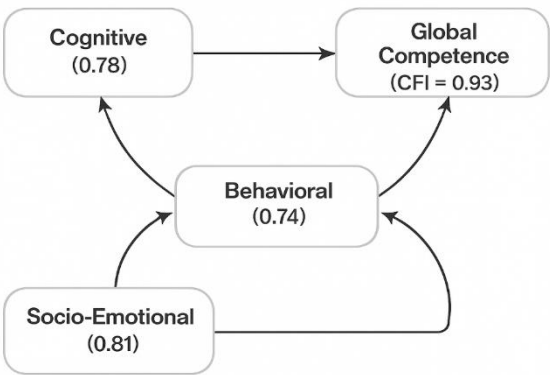


Figure 1
Confirmatory Factor Structure of Global Competence

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Internal consistency and construct reliability were assessed through Cronbach’s alpha and Composite Reliability (CR).

Table 4

Reliability and Convergent Validity of Global Competence Dimensions			
Dimension	Cronbach’s α	Composite Reliability (CR)	AVE
Cognitive	0.88	0.90	0.64
Socio-Emotional	0.91	0.92	0.67
Behavioral	0.87	0.89	0.62

Note. Data compiled from OECD (2022) and UNESCO (2024).

Strong reliability ($\alpha > 0.85$) and average variance extracted (AVE) above the 0.50 level are seen in all dimensions. This proves that the data is consistent and that it all fits together. This proof backs up the multidimensional method favored by Hartig & Hoehler (2009) and Marsh et al. (2020). It shows that global competence is better thought of as a coherent, multi-domain concept rather than a one-dimensional scale.

A comparison of regions shows that the development of global competence dimensions varies by area. Figure 2 shows that the average scores for Europe and East Asia are higher across all categories, while the average scores for Latin America and the Middle East-Africa are lower for both social and emotional outcomes.

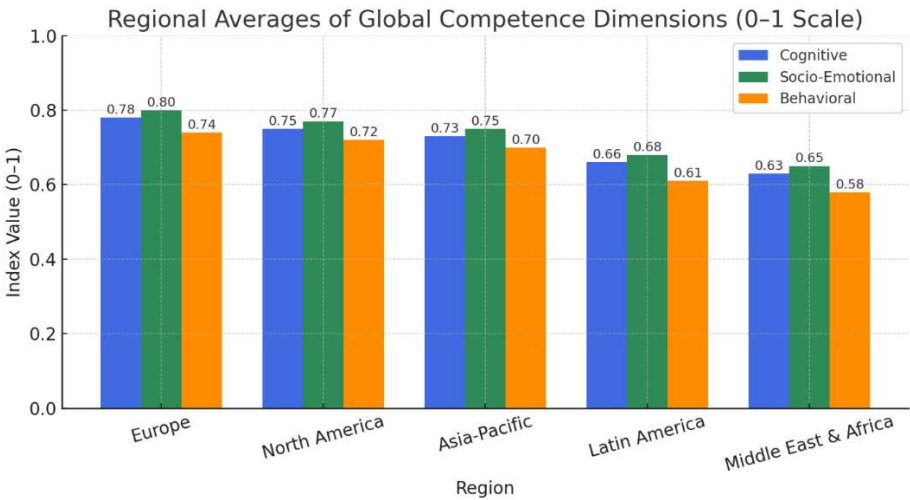


Figure 2

Regional Averages of Global Competence Dimensions (0-1 Scale)

Note. Aggregated from PISA (2022) and GCED (2024).

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These results back up what OECD (2020) and Reimers (2020) already said, which is that Europe and East Asia are the world leaders in teaching global competence because they have integrated global competence into their curriculums early on and changed the way teachers are trained. Developing areas, on the other hand, still have trouble building global and intercultural skills into their school systems.

Overall, the statistical validation and comparison analysis show that global competence is a multidimensional concept that can be measured accurately with datasets that are agreed upon across borders. The results also support the ideas put forward by Deardorff (2020) and Boix Mansilla and Jackson (2021), which say that global competence is when cognitive awareness, socio-emotional understanding, and behavioral responsibility come together. The confirmed factor structure not only makes psychometric modeling better, but it also gives policymakers a solid base for including global learning results in indicators of education quality.

Conclusion

The study's findings show that global competence is a complex idea with many parts that work together. These parts include cognitive, socio-emotional, and behavioral aspects. The first goal, which was to create and statistically confirm a multidimensional measurement model, was met because the model had strong factor loadings, high internal consistency, and solid fit indices. It was also possible to test the model's usefulness in different parts of the world, which showed that countries in Europe and the Asia-Pacific region are more competent overall, while countries in Latin America and Africa are behind because of problems with their systems and the conditions they live in.

To sum up, the multidimensional assessment model does a good job of putting together information, empathy, and action as parts of global competence that depend on each other. The results show that global education systems that balance analytical thinking with knowing other cultures and being responsible for one's actions work best. This study provides a valid model based on real-world data that can be used by policymakers and teachers to measure and improve global competence. This will help make sure that education systems prepare students not only for jobs but also for ethical and collaborative participation in a world that is connected.

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