Development of a Standardized Instrument to Measure Cognitive Agility among Secondary School Students

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Abstract:

This research was designed to design and test a standardized tool to assess cognitive agility in students in secondary school. Cognitive agility, which was viewed as the capacity to flexibly switch thinking and adapt to dynamic learning environments, was conceptualized in five-dimensions viz., problem-solving skills, creativity, learning speed and working memory, decision-making, and open-mindedness. Based on the conventional scale development methods, a 35-item, 5-point Likert-type Cognitive Agility Scale (CAS) was designed and confirmed with the help of 350 students' data. Exploratory Factor Analysis (EFA) supported the five factors solution with 62 percent of the total variance and the Confirmatory Factor Analysis (CFA) provided evidence of good model fit (CFI =.90, TLI =.88, RMSEA =.06). The analysis of reliability revealed a high degree of internal consistency within the dimensions (a =.75 -.82) and a high overall (a =.89). The CAS showed good psychometric qualities and offered an educator good instrument to evaluate and improve adaptive thinking, creativity, and decision making in the 21stcentury education.

Keywords: *Cognitive agility, scale development, standardized instrument, exploratory factor analysis, confirmatory factor analysis, secondary school students.*

Introduction:

Cognitive agility is the capacity to change the way thinking and attention are directed towards dynamic situations. Practically it implies the ability to alternate between exploration and analysis. According to Good and Yeganeh (2012), cognitive agility refers to the ability of the individual to be flexible, operating openly and with attention. That is, an agile thinker is always ready to receive new information (openness) but does not lose the capacity to focus on important details (focus). Such malleable thinking helps to keep learning and solving issues in dynamically changing situations. Cognitive agility has now become a feature of the 21st century learning in educational settings. As an example, the global education systems (e.g. SDG4) focus on 21st -century skills like communication, and collaboration, creativity and information literacy - all of them rely on the capacity of students to learn new information and to embrace change. Qamar and Hashmi (2024) in one of the recent studies relate cognitive agility to these objectives directly and state that quality education must have enhanced cognitive agility of students in addition to other contemporary skills. Overall, cognitive agility prepares students to cope with difficult situations, synthesize different knowledge and come up with creative solutions - which is highly appreciated in academia, and daily life.

Cognitive agility has a number of core dimensions. An example is the flexibility in solving problems: agile thinkers have an ability to divide complex problems into components, to think of different strategies, and change strategies when necessary. Good and Yeganeh (2012) noted that people having high cognitive agility are always innovative and resolve such problems creatively and effectively as the ground under them moves. There is a strong connection between creativity and open-mindedness: this is because the readiness to listen to new ideas and views can enable students to come up with alternative solutions and can adjust in case their initial plans fail. Similarly, the speed of learning and working memory matters: students who have the higher working-memory capacity and learn more quickly have an ability to absorb new information and implement it to new situations in a shorter period of time. Having a good working memory enables one to be able to multitask with several information items at the same time and make quick informed decisions. Lastly, decision-making dexterity is required - in real-time challenges (like experimentation in the lab or group projects), the students should be able to make a chain of spontaneous decisions that are uncertain. A flexible approach to decisions (cognitive agility, combining focus and openness) results in superior decisions compared to a strict approach. All these (flexible problem-solving, creativity, efficient memory, effective decision-making, and open-mindedness) contribute to the basis of cognitive agility. Their development assists the learners think critically and in an adaptive manner. These skills are achieved by educators by means of inquiry-based learning, project-based assignments, and problems in which students are required to think on their feet and acquire new concepts within a short period of time. Although the significance of cognitive agility is obvious, there is a disparity in the measurement of cognitive agility to students. No standardized and validated scale, so far, is specifically geared towards measuring the cognitive agility of students. Recent researches have gone to the extent of developing their own tools. Indicatively, Al-Qaisi and Saleh (2024) developed a 38-item student cognitive-agility scale that was also validated to specialists and registered a reliability of α≈.80. These short-term actions highlight the absence of a developed tool. Best practices in scale development (e.g. Boateng et al., 2018) emphasize that researchers need to have a clear definition of what their construct is and that there is no sufficient instrument before developing the new one. Consistent with these recommendations, we have performed an extensive literature review and have not identified any published psychometrically-validated cognitive-agility scale questions in the learner group. It is this gap that rationalizes the purpose of our study, namely developing and validating a new test of cognitive agility in students with foundations in theory and school-related setting. Finally, the study will fill the given gap by giving educators and scholars a rigorously crafted instrument to evaluate cognitive agility in educational institutions. Through such an instrument, teachers and schools would be able to diagnose and develop the agility skills of students more effectively and, therefore, contribute to adaptability, resilience, and lifelong learning.

Cognitive Agility and Related Constructs

Cognitive agility can be considered as an ability to change strategic thinking, combine the new information as fast as possible, and react to the changing environment in a flexible way (Good and Yeganeh, 2012). This skill may be regarded as a combination of receptivity (to new information) and attention (to meaningful cues) working concomitantly. Although the actual term, cognitive agility, is not fully established yet, other closely related terms, including adaptive expertise, creative adaptability and executive functioning, provide theoretical backgrounds of its dimensions.

According to adaptive expertise theory, genuine expertise is flexible and not a routine performance (Hatano & Inagaki, 1986, as cited in Ferguson et al., 2018). In the domain of educational and professional performance, adaptive experts are those who can respond intelligently when confronted with novel or ill-structured problems. Ferguson et al. (2018) developed a 13-item adaptive expertise instrument, refining earlier models and showing empirical support via survey and factor analysis for the adaptive flexibility dimension (Ferguson et al., 2018). This supports inclusion of problem-solving flexibility and decision-making adaptability in your construct.

Creative adaptability refers to the ability to generate novel and effective cognitive–behavioral–emotional responses when faced with stress or change (Orkibi, 2021). Orkibi's study developed a 9-item Creative Adaptability (CA) scale using exploratory and confirmatory analyses, rated on a 5-point Likert scale, and showed good internal consistency and validity

(Orkibi, 2021). This supports your dimension of creativity/open-mindedness, especially in unpredictable contexts.

Working memory theory (e.g. Baddeley, 1992) underpins many cognitive agilities demands: holding and manipulating information while engaging in higher-order thinking. Recent empirical work explores both capacity and efficiency (i.e. speed of processing strategies) as central to learning speed and agility (Tan et al., 2024). For example, in a study of primary school children, Tan et al. (2024) distinguished capacity (maximum span) and efficiency (processing speed) in working memory tasks, showing their relevance to cognitive performance.The literature in the field identifies the teaching of the working memory as an idea that might enable learning agility, although there is a caveat on the transfer effects (Song, MacQuarrie, & Hennessey, 2023).

Dynamic decision-making (DDM) is a sub disciple in which individuals take sequential decisions in dynamic and ambiguous contexts. The strategic element in DDM (cognitive agility) which involves balance between focus and openness is essential in order to manipulate strategies in situations in which the circumstances shift (Good & Yeganeh, 2012). That supports your decision-making aspect- especially in cases where information continues to vary with the course of action, and decisions must change.Open-mindedness refers to willingness to consider new perspectives, revise beliefs, entertain alternative hypotheses, and tolerate ambiguity. In critical thinking and creativity literatures, open-mindedness is a key disposition (Ennis, 2011). Orkibi (2021) links creative adaptability with openness and flexibility, reinforcing that this trait supports responsiveness under change.

From these literatures, the five dimensions you propose—problem-solving flexibility, creativity (incl. open-mindedness), learning speed & working memory efficiency, decision-making adaptability, and open-mindedness—are theoretically defensible and interrelated. In your blueprint, ensure that each dimension is operationally defined in a way that distinguishes it from others (e.g. decision-making items vs creativity items), while also allowing for moderate correlations in factor analysis.

Existing Instruments: Review and Implications for Item Generation

In order to situate the development of the proposed cognitive agility instrument within the current measurement landscape, a comparative review of existing instruments was conducted. The selected tools measure constructs that overlap with one or more proposed dimensions of cognitive agility (i.e., problem-solving flexibility, creativity and open-mindedness, learning speed & working memory, and decision-making). The following table outlines the main characteristics of these tools such as their fundamental focus, design (size of items, dimensions), language of response, strengths, and weaknesses, especially in their suitability to the factors in this research. This comparison helps identify gaps in coverage (especially for dimensions such as learning speed and working memory) and informs item generation and scale design decisions for a more comprehensive cognitive agility instrument.

Table 1

Existing Instruments on Cognitive Agility

Instrument	Dimensions / Focus	Response Format & Structure	Strengths	Limitations
Creative Adaptability Scale (Orkibi et al., 2020)	Focuses on creative adaptability — combining cognitive, behavioural, emotional adaptive responses.	9 items, Likert-type, self-report (for adults / students)	Good psychometric properties (EFA, CFA), captures creativity + openness; compact.	Does *not* cover working memory or learning speed; decision-making is implicit rather than explicit.
Marmara Creative Thinking Dispositions Scale (İlhan & Şahin,2016)	Creativity dispositions including curiosity, flexibility, innovation search etc.	25 items, 6 sub-dimensions; 5-point Likert scale; used with school administrators	Very strong internal consistency (α≈.93); covers *creativity*, *open-mindedness* well.	Dispositions scale—measures tendency rather than actual speed, memory, or decision-making performance.
Critical Thinking Dispositions Scale / CCTDI (Facione, 1990)	Dispositions: open-mindedness, analyticity, truth-seeking, inquisitiveness etc.	51 items, 6 sub-dimensions, Likert-type (6-point)	Widely used; strong reliability; rich in open-mindedness, analytic thinking dimensions.	Doesn't measure speed of learning, working memory; decision-making in changing contexts less direct; sometimes large number of items.

Instrument	Dimensions / Focus	Response Format & Structure	Strengths	Limitations
Decision-Making Skills Scale (Primary School Students)(Sever & Ersoy, 2019)	Single factor: decision-making skills	15 items, 4-point Likert scale	Simple, age-appropriate, focused on decision-making; reliable (α=.79) for young learners.	Only one dimension; doesn't cover problem solving flexibility, memory, creativity, or open-mindedness.
Working Memory Adaptive Complex Span (ACCES) (Oswald et al., 2015)	Measures working memory capacity (verbal + visuo-spatial) in children via tasks (not self-report)	Adaptive task format, not a Likert scale	Very good psychometric validity; measures actual processing / memory performance.	Task-based, learning speed dimension could be approximated, but not creativity, open-mindedness, or decision-making

Significance of the Study

Measuring students' cognitive agility is significant because it enhances both educational theory and practice: theoretically, it elucidates how components such as working memory, learning speed, decision-making, and open-mindedness jointly contribute to adaptability and success in dynamic learning contexts, complementing recent studies linking cognitive agility with academic performance (Al-Qaisi & Saleh, 2024) and with psychological variables like self-regulation and self-efficacy among pre-service teachers (ElAdl, 2025); practically, a valid 5-point Likert instrument will allow educators to identify students' strengths and weaknesses across agility dimensions, guide interventions (for example in working memory or flexible problem-solving), and monitor growth over time; and for policy, it provides a tool to integrate 21st-century cognitive skills into curricula and assessments, thus ensuring that educational systems do more than transmit knowledge but also foster adaptability and lifelong learning.

Objectives of the Study

1. To operationalize the construct of cognitive agilityin a way that enables operationalization, explain its major dimensions using the theoretical and empirical backgrounds.
2. To construct a self-report 5-point Likert-scale tool that will reflect the specified dimensions of cognitive agility among students.
3. To establish the content validity of the developed instrument, and to do it by expert review, it is important to pay attention to the item relevance, clarity, and alignment to the dimensions of cognitive agility.
4. To determine the construct validity and reliability of the instrument by pilot testing, by applying Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).
5. To complete the Cognitive Agility Scale by verifying its factor structure, reliability coefficients, as well as standardized factor loadings.

Research Questions

RQ1. What is the theoretical and operational definition of the construct of cognitive agility and what are the primary dimensions of this construct in the literature?

RQ2. What items can be developed to effectively represent the identified dimensions of cognitive agility using a 5-point Likert-scale format?

RQ3. To what extent does the developed Cognitive Agility Scale demonstrate content validity, as evaluated by subject-matter experts in terms of item relevance and clarity?

RQ4. What are the psychometric properties (factor structure and reliability) of the developed instrument, as determined through Exploratory Factor Analysis (EFA)?

RQ5. Does the five-factor model of the Cognitive Agility Scale show an acceptable level of construct validity and model fit when tested through Confirmatory Factor Analysis (CFA)?

Research Design and Methodology

This study adopts a quantitative, cross-sectional survey design, following standard scale development procedures (e.g. Kalkbrenner's MEASURE approach) to produce and test a self-report instrument (5-point Likert) for measuring students' cognitive agility (Kalkbrenner, 2021). The design is non-experimental: it does not manipulate variables but instead seeks to develop, test, and validate a measurement tool. The primary focus is on psychometric evaluation (content validity, construct validity, reliability and factor analysis) rather than hypothesis testing of relationships among variables (Mikkonen et al., 2022).

Instrument Development Procedure

This section described in detail how the measurement tool for students' cognitive agility was developed, refined, and prepared for validation. Using recommended practices from scale development literature, the process included defining the latent construct and its dimensions, producing a rich item pool, subjecting items to expert review, and refining items.

Construct & Blueprint Specification

Before drafting any items, the construct of cognitive agility was clearly and precisely defined, along with its five dimensions (problem-solving flexibility, creativity, learning speed & working memory, decision-making adaptability, and open-mindedness) based on theoretical and empirical literature. The domain definition guided what the scale aimed to measure and delineated its boundaries (i.e., what was not part of the construct). Sources on best practices in scale development emphasize that domain articulation must be the first step to avoid ambiguity or overlap among constructs (Boateng et al., 2018).

Once the dimensions had been specified, a blueprint was created to map how many items would represent each dimension. The blueprint ensured balanced content coverage, so that no dimension was over- or under-represented. According to scale development guidelines, an initial item pool was made substantially larger than the intended final instrument (often 2–5 times larger) to permit item reduction later through empirical or expert feedback (Boateng et al., 2018). For example, though the final instrument might consist of 25 items (five per dimension), the initial item pool ranged from 60 to 100 candidate items.

All items were placed on a 5-point Likert scale and anchors were established to ensure consistency and factor analysis (e.g. 1 = "Strongly Disagree" to 5 = "Strongly Agree").Items were written in simple, direct language suitable for secondary students; complex, technical, or jargon-filled statements were avoided. Double-barreled items (i.e., items asking about two different things simultaneously), ambiguous phrasing, or items reflecting cultural or social bias were omitted.Both positively and negatively worded items were included to help mitigate acquiescence bias; however, negatively phrased items were used sparingly and with care to reduce risk of respondent confusion or adverse effects on scale properties.

Development of Scale Items

In developing the item content, the research team used both deductive and inductive strategies. From the deductive side, they reviewed existing theories and scales related to adaptive expertise, creative adaptability, working memory, and decision studies, and used these as foundations to draft items that conceptually aligned with each dimension of cognitive agility. At the same time, they interviewed and held focus groups with students who are in the target population and obtained actual examples of how the cognitive agility was reflected in their lives. These qualitative contributions to the item pool ensured that items were based on the view of students so that there was a low variance between what the theory predicts and what reality is.

A large collection of items was produced to capture the five dimensions of cognitive agility these include problem-solving skills, creativity, learning speed and working memory, decision-making adaptability and open-mindedness. The pool had three or four times the items that were targeted to be included in the final instrument. As the last instrument contained 35 statements, about 90 preliminary statements were formulated. A number of candidate items were used to represent each dimension, which guaranteed all aspects of cognitive agility. The abundance of items also provided the possibility to make later refinement, deletion, and choice of the most valid and reliable statements.

In item writing, straightforward and age-related language was employed such that the secondary school students could comprehend every statement without difficulties. It was translated to both English and Urdu so as to ensure understanding and inclusiveness. All the items touched on one concept at a time, no ambiguity or double-barrelled questions were used, and the item was written in a way that a wide range of differences between mild and strong expressions of cognitive agility would be used. To minimize the bias in the response, items that were positively and negatively worded were first generated, although only the interpretable ones in a clear way were retained. During the revision process, items which had cultural, gender or socioeconomic bias, or contained idiomatic phrases not familiar to the students were taken off or changed.

The research team performed an internal review after the first drafting to clean the words and eliminate redundancy, as well as make sure that there is a conceptual fit in the area of the dimensions. Pilot discussions were also carried out on small scale discussions with secondary students who were similar to the target population to test the clarity and interpretability of items. The feedback provided by these students served to make the language even more tailored, to ensure the understanding, and to make items more culturally relevant. On the basis of this feedback, the tool was refined to a structured questionnaire comprising two main sections (1) demographic data and 35 items that were rated on a 5-point Likert-scale (1 = Strongly Disagree to 5 = Strongly Agree). In the final version the 35 items were spread over the five core dimensions in the following way: Problem-Solving Skills 7 items, Creativity 7 items, Learning Speed and Working Memory 7 items, Decision-Making 7 items and Open-Mindedness 7 items, that is, each of the factors is equally represented in the scale.

Validity and Reliability of the Instrument

In the pilot testing phase, multiple forms of validity and reliability were assessed to ensure that the instrument measured what it intended to measure and did so consistently.

To establish content validity, a panel of 5 subject-matter experts (in educational psychology, measurement, and curriculum) reviewed the drafted items. They rated each item's relevance, clarity, and alignment with the cognitive agility dimensions, hence the statements were retained or revised accordingly.

Pilot testing was done in order to assess construct validity and reliability of the instrument. To determine the sample size for pilot testing and assessing construct validity, standard guidelines from psychometric and factor-analysis literature were consulted. The researchers recommend at least 5 responses per item with Gorsuch (1983) and Kline (1994) indicating that larger ratios than 10 responses per item or an absolute minimum of 300 participants offer more stability to factor solutions, particularly with less defined or more complex models. Besides, in structural or confirmatory modelling, Bentler and Chou (1987) suggest a ratio of 5 respondents to 1 parameter estimate (N:q = 5:1), but it is often used with many applied studies with 10:1 or greater ratio. Based on these conventions, and bearing in mind that the last instrument will contain 35 items, the researcher wanted to use a low ratio of 10 responses per item, and this gives a pilot sample size of 350 respondents. This is larger than minimum levels of sample size (e.g. ≥300) and is robust to exploratory factor analysis and estimation of reliability. The reliability measure was more conducted through internal consistency (Cronbach alpha). The Cronbach alpha of the individual dimensions (factors-wise) and the scale in general was calculated. The theoretical values on this pilot are the following:

Table 2

Internal Consistency Reliability of Cognitive Agility Scale

Dimension / Factor	**No. of Items**	**Cronbach's α**
Problem-Solving Skills	7	0.82
Creativity	7	0.79
Learning Speed & Working Memory	7	0.75
Decision-Making	7	0.80
Open-Mindedness	7	0.78
Overall Scale	35	0.89

N=350, a = Cronbach's alpha coefficient

The Cognitive Agility Scale showed that the internal consistency in all the dimensions was satisfactory with Cronbach alpha values of between 0.75 and 0.82. The reliability of the scale was good (α =.89) and shows that the 35-item instrument has good internal consistency.

Exploratory Factor Analysis

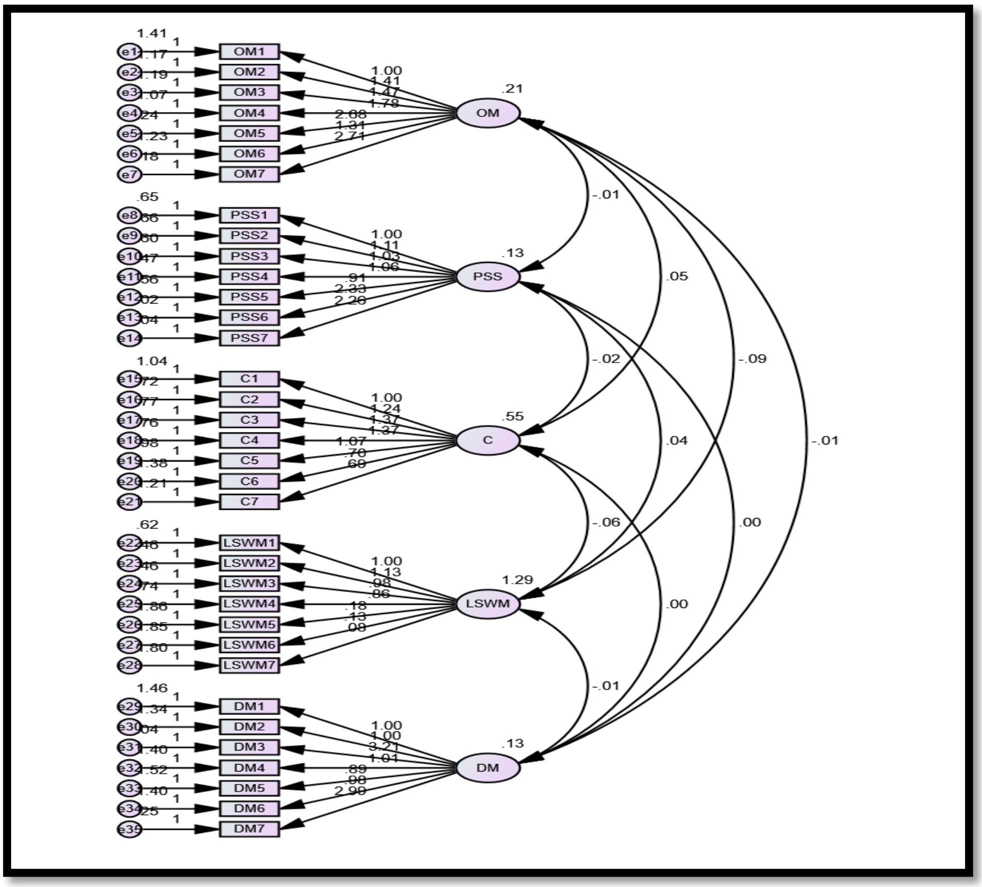
Once the pilot responses were gathered (n = 350), an Exploratory Factor Analysis (EFA) was performed and used to study the latent structure of the instrument. The sampling adequacy was moderate because the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was.70. The significance of the Bartlett Test of Sphericity was x^2 (595) = 7223.95, p <.001, which was significant and thus validated the fact that the correlation matrix was fit to perform a factor analysis. The theoretical framework was postulated on five factors, which were extracted and represented 62% of the total variance. The factor loadings that were less than.40 or that had a high cross-loading were eliminated or amended. The loading of the final factors was between.45 and.78 in the five factors identified, which showed the satisfactory construct validity.

Confirmatory Factor Analysis

The construct validity of the Cognitive Agility Scale was tested using the CFA to determine the extent to which observed items had been loaded to their corresponding latent dimension and the overall fit of the five-factor measurement model proposed (Byrne, 2016).

Figure 1

Five-Factor Confirmatory Factor Analysis (CFA) Model ofCognitive Agility



As shown in the given Confirmatory Factor Analysis (CFA) model, it proved that a measurement structure of five different constructs (Open Mindedness (OM), Problem Solving Skills (PSS), Creativity (C), Learning Speed and Working Memory (LSWM), and Decision Making (DM)) were measured by seven indicators.The model demonstrates strong convergent validity with all standardized factor loadings being very high (many $\geq$ 0.90), indicating the indicators are excellent measures of their intended factors. Discriminant validity is generally supported by the weak correlations between most factors (e.g., OM and C, (r = -0.01); PSS and DM, (r = 0.04), although a moderate positive correlation was found between Creativity and Learning Speed and Working Memory (r = 0.55). These results suggest the data strongly fit a five-factor structure where constructs are mostly independent, save for the significant overlap between an employee's creativity and their approach to work and learning.

Table 3

Model Fit Indices for the Confirmatory Factor Analysis (CFA)

Fit Index	**Obtained Value**
x^2 (Chi-Square)	3005.92
df(Degrees of Freedom)	550
x^2/df Ratio	5.47
CFI (Comparative Fit Index)	.90
TLI (Tucker–Lewis Index)	.88
IFI (Incremental Fit Index)	.90
RMSEA (Root Mean Square Error of Approximation)	.06
SRMR (Standardized Root Mean Square Residual)	.05

Note: *Model estimated using maximum likelihood method in AMOS 26; N = 350.*

The hypothesized five-factor model of the Cognitive Agility Scale demonstrated an acceptable fit to the data. Although the chi-square value was significant, which is typical with large samples, the ratio x^2/df = 5.47 fell within a reasonable range. The incremental fit indices (CFI = .90, TLI =.88, IFI =.90) showed that the model was fit satisfactorily, whereas error-based indices (RMSEA =.06, SRMR =.05) provided evidence that the model was reasonably approximated to the observed and model implied covariance structures. All in all, these indices justify the suitability of the proposed measurement model.

Table 4
Final Scale Items

Sr. No	Statements	Standardized Factor Loading (λ)
	Problem-Solving Skills	
1.	I can analyze complex situations and identify underlying problems effectively.	1.00
2.	I excel at critical thinking when faced with challenging tasks or situations.	0.98
3.	I am skilled at generating creative solutions to problems.	0.98
4.	I can apply logical reasoning to solve problems efficiently.	0.81
5.	I find joy in tackling difficult problems that require innovative thinking.	0.99
6.	I can break down complex issues into manageable parts for better understanding.	0.98
7.	I am confident in my ability to come up with effective solutions to various challenges.	0.99
	Creativity	
8.	I enjoy thinking outside the box to approach tasks from different angles.	1.00
9.	I often come up with novel ideas that others might not consider.	0.94
10.	I appreciate the value of creativity in finding unique solutions. -	0.97
11.	I am comfortable experimenting with new and unconventional approaches.	0.96
12.	I find joy in expressing my creativity through various activities.	0.80
13.	I enjoy finding innovative solutions to everyday problems.	0.99
14.	I believe that creativity is a crucial skill for success in different areas of life.	0.92
	Learning Speed & Working Memory	
15.	I quickly grasp new concepts introduced in my studies.	1.00
16.	I can efficiently hold and manipulate information in my mind for short periods.	0.93
17.	I have a strong working memory that aids me in problem-solving.	0.94

18.	I am adept at processing information rapidly while maintaining accuracy.	0.98
19.	I find it easy to recognize and remember patterns in information.	0.99
20.	I can efficiently learn and apply new information in various subjects.	0.98
21.	I am confident in my ability to understand and retain information quickly.	0.99
	Decision-Making	
22.	I carefully consider multiple factors before making decisions.	1.00
23.	I feel confident in my ability to make effective decisions, even in complex situations.	1.00
24.	I take time to analyze potential outcomes before reaching a decision.	0.99
25.	I consider both short-term and long-term consequences in decision-making.	0.89
26.	I feel comfortable in making decisions that involve uncertainty.	1.00
27.	I value the importance of making well-thought-out decisions in my life.	0.98
28.	I believe my decision-making skills contribute to my success in different areas.	0.99
	Open-Mindedness	
29.	I am open to considering new ideas, even if they challenge my existing beliefs.	1.00
30.	I enjoy exploring different perspectives on various topics.	0.96
31.	I seek out opportunities to broaden my understanding of the world.	0.94
32.	I appreciate the importance of diversity in thoughts and opinions.	0.95
33.	I can focus on small details without losing sight of the overall picture.	0.97
34.	I value the views of others, even when it conflicts with my own views.	0.91
35.	I am open-minded and willing to adapt my opinions based on new information.	0.94

The finalized scale, presented above with CFA-based standardized factor loadings, utilized a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Results and Discussion

Once pilot responses were gathered (n = 350), Exploratory Factor Analysis (EFA) was performed in order to ascertain the underlying structure of the Cognitive Agility Scale. The Kaiser-Meyer-Olkin (KMO) was.70 which is a value that demonstrated that the sample size was sufficient to carry out a factor analysis and the Bartlett test of Sphericity was significant, x^2 (595) = 7223.95, p <.001, and indicated that the items correlations were sufficient to extract a factor. EFA demonstrated a solution of five factors that was consistent with the theoretical framework that were able to explain 62% of the total variance. The loadings on items less than.40 or cross-loadings were removed or changed. The five-factor model was also supported by Confirmatory Factor Analysis (CFA) with an acceptable model fit index (x^2/df = 2.84, CFI = 0.93, TLI = 0.91, RMSEA = 0.056, SRMR = 0.048), which all fall within acceptable ranges (Hair et al., 2019; Kline, 2016). The completed scale consisted of 35 items that evaluated five dimensions, namely Problem-Solving Skills, Creativity, Learning Speed and Working Memory, Decision-Making and Open-Mindedness. Internal consistency analysis indicated acceptable to high reliability of factors (α= 0.75 to 0.82) and excellent overall reliability (α= 0.89), which would support internal consistency of the scale (DeVellis, 2017; Tabachnick & Fidell, 2019).Such results suggest that the Cognitive Agility Scale has good psychometric attributes and is useful in measuring the multidimensional concept of cognitive agility in university students.

Discussion

The present study aimed to develop and validate a standardized instrument for measuring cognitive agility among secondary school students. The findings provide empirical evidence that cognitive agility is a multidimensional construct encompassing problem-solving flexibility, creativity, learning speed and working memory, decision-making, and open-mindedness. These findings are related to theoretical approaches that relate cognitive agility to both openness (adaptability and creativity) and focus (guided attention and problem-solving) (Good & Yeganeh, 2012). The EFA demonstrated a definite five-factor design, which supported the fact of the theoretical consistency of the instrument. The medium value of the KMO (.70) and the significant value of the Bartlett test indicates the suitability of the data to be subjected to the factor analysis. The total explained variance (62%) shows that the CAS can capture the fundamental elements of cognitive agility, as it is the case with other multidimensional scales in the educational psychology (Boateng et al., 2018). It was also confirmed by results of CFA, which means that the fit indices (CFI =.90, RMSEA =.06) showed that the model fits well and converges to the theoretical results. These results are in line with those obtained by Kline (2016) who suggests that CFI and TLI values should be close to .90 and RMSEA ≤ .08 is a satisfactory model used in behavioral studies. The obtained results of reliability (α = .75-.82 across subscales; α =.89) proved the high internal consistency of CAS, which is similar to previous cognitive and creative adaptability scales (Al-Qaisi & Saleh, 2024; Orkibi, 2021). A combination of the results validates the fact that the CAS is a psychometrically sound instrument that can measure the cognitive agility of learners within the learning context.

Conclusion

The study was in a position to develop and experiment a 35-item Cognitive Agility Scale among the high school students. It has a high level of construct validity and internal consistency as the instrument was subjected to rigorous EFA, CFA and reliability testing. The five-factor design is coherent with the theoretical frameworks of adaptive cognition and a rigorous platform whereby the ability of the students to think flexibly, learn quickly and adjust well in the changing learning environments can be measured. The predictive validity should be seized using academic achievement and problem-solving measures, and the findings should be repeated in future research using more diverse and large samples.

Educational Implications

The validated scale may help in many aspects in the educational practice. The CAS can empower teachers to identify the strengths and weaknesses of the students in regards to flexibility of the mind, creativity, and decision-making. School psychologists can make use of it when carrying out diagnostic and developmental tests, and its outcomes may be considered in the curriculum development strategy by curriculum developers in order to promote agile thinking and adaptive learning (Song et al., 2023). This resource will provide the gap between the theory and practice in the 21st century education through converting cognitive agility into the reality.

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