



# Evaluating the Effectiveness of Storytelling in Economics Education: Development of Measurement Scales

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**Abstract:** This study examines the effectiveness of storytelling as a pedagogical tool in economics education compared to traditional textbook methods. While textbooks provide structure, they often fail to engage students deeply. Storytelling, by presenting economic concepts in relatable narratives, can enhance comprehension, engagement, and retention. The study develops and validates a measurement scale—the TIDE (The Indian Dream Economics) Scale—to assess student preferences and perceptions of storytelling in economics classrooms.

The instrument was designed through student feedback, expert review, and pilot testing. An initial pool of 60 items was refined to 24 after factor analysis with 700 participants. The scale captures five dimensions: effectiveness and engagement, interest, understanding, retention, and adaptability/relevance. Reliability testing yielded a Cronbach's alpha of 0.92, indicating strong internal consistency. A composite TIDE Index was also developed to quantify overall effectiveness.

Findings confirm storytelling's multidimensional impact, highlighting its ability to make economics more accessible and meaningful. The validated scale offers a robust tool for educators and researchers, enabling curriculum design that balances narrative and traditional methods. This study contributes to educational measurement by introducing a comprehensive, context-specific scale for evaluating innovative teaching strategies.

**Keywords:** storytelling, economics education, student engagement, measurement scales, factor analysis

**JEL Codes:** A20, A22, C38

## I. Overview of the Instrument

To effectively evaluate the use of storytelling as a pedagogical tool in microeconomics, a well-designed instrument is essential. This instrument, in the form of a survey, serves as a crucial tool for capturing and quantifying students' perceptions and attitudes. By systematically gathering data, the survey provides a structured approach to understanding the various dimensions of how storytelling impacts student engagement, comprehension, and retention of economic concepts. The careful design of this instrument ensures that it can provide actionable insights into the educational efficacy of storytelling within this specific academic context.

Central to this instrument is the use of a Likert scale, which allows for the nuanced capture of participants' responses. Through a series of carefully crafted statements, the survey explores different aspects of students' experiences with storytelling in economics education. By inviting participants to express their level of agreement or disagreement, the survey effectively measures subtle variations in attitudes. This methodological approach not only enhances the reliability of the data collected but also ensures that the resulting analysis is robust, providing a comprehensive understanding of the role storytelling plays in enhancing learning outcomes in microeconomics.

## II. Development of the Instrument

### 1. *Literature Review on Existing Instruments and the Need for a New Instrument*

The review of existing literature reveals a variety of scales developed to measure constructs such as engagement, interest, and effectiveness in educational settings. Prominent among these are the National Survey of Student Engagement (NSSE), the Motivated Strategies for Learning Questionnaire (MSLQ), and the Classroom Engagement Inventory (CEI). These instruments are designed to assess traditional lecture-based teaching methods and do not fully capture the nuances of alternative pedagogical approaches such as storytelling.

For instance, the NSSE (National Survey of Student Engagement (NSSE), n.d.) focuses on measuring student participation in educational practices, the MSLQ (Pintrich, Smith, Garcia, & McKeachie, 1993) assesses motivational orientations and learning strategies, and the CEI (Wang, Bergin, & Bergin, 2014) evaluates behavioural, emotional, and cognitive engagement in classroom settings. However,

none of these scales explicitly address the unique characteristics and potential benefits of storytelling as a teaching method.

Research on storytelling as a pedagogical tool indicates its effectiveness in enhancing various learning outcomes. Studies by Haven (2007) and Rossiter (2002) suggest that storytelling can improve students' engagement, comprehension, and retention of material by making learning more relatable and memorable. Despite this, existing instruments do not adequately measure these storytelling-specific impacts, particularly in the context of economics education.

To establish reliable and valid instruments, appropriate sample sizes are crucial. Hinkin (1998) recommends a sample size of at least 150 to 200 participants for factor analysis in scale development. Similarly, Costello and Osborne (2019) suggest that larger sample sizes increase the stability and generalizability of factor structures, with a minimum of five participants per item being a common guideline. These benchmarks were considered in the development of the new instrument to ensure robust psychometric properties.

The development of the new instrument required the establishment of clear attitudinal themes and sub-themes. Drawing from the literature, the primary themes identified include engagement, interest, understanding, retention, relevance, adaptability, effectiveness, and critical thinking. Each theme represents a distinct dimension of students' attitudinal and cognitive responses to storytelling as a teaching method.

Research by Fredricks, Blumenfeld, and Paris (2004) categorizes *engagement* into behavioural, emotional, and cognitive dimensions. This multi-dimensional approach ensures a comprehensive assessment of student involvement in the learning process. Higi and Renninger (2006) emphasize the importance of situational and individual *interest* in educational settings, highlighting how storytelling can capture and sustain students' attention. Studies by Mayer (2002) and McDaniel, Anderson, Derbish, and Morrisette (2007) demonstrate that storytelling enhances *understanding* and *retention* by providing context and making information more memorable. The ability of students to see the *relevance* of their learning to real-world contexts and *adapt* what they have learned to different situations is critical. Research by Frymier and Shulman (1995) underscores the importance of perceived relevance in student motivation and learning outcomes. Assessing the overall effectiveness of storytelling as a teaching method involves understanding its impact on student learning outcomes and satisfaction. Studies by Green and Brock (2000)

and Schank (1995) provide evidence for the *efficacy* of narrative-based instruction. Kuhn (1999) and Halpern (1998) highlight the role of instructional methods in fostering *critical thinking* skills. Storytelling, by presenting complex scenarios and encouraging analytical thinking, can significantly contribute to this dimension.

Each of these themes was supported by a minimum of five carefully crafted statements, ensuring comprehensive coverage of the constructs and allowing for detailed analysis of students' responses.

The literature review highlights the inadequacies of existing scales in capturing the specific impacts of storytelling in an educational context, particularly within economics. By identifying this gap, the need for a new instrument became evident. This new instrument, developed through rigorous item generation and refinement processes, aims to measure the nuanced effects of storytelling on student engagement, interest, understanding, retention, relevance, adaptability, effectiveness, and critical thinking. The thorough review of sample size requirements and thematic constructs provides a solid rationale for the construction and validation of this new scale, ensuring its reliability and validity in capturing the attitudinal and cognitive dimensions influenced by storytelling as a pedagogical tool.

## ***2. Process of Item Generation***

The process of item generation was iterative and based heavily on the qualitative feedback from students. Initially, students' statements were collected and categorized into themes that reflected different aspects of their learning experience. These themes were then translated into item statements, ensuring that each statement was clear, concise, and relevant to the constructs being measured.

Each statement was carefully crafted to capture a specific attitude trait. After generating an initial pool of 60 statements, a panel of experts reviewed them for content validity. This panel included experienced educators and researchers familiar with both storytelling and educational assessment. Based on their feedback, redundant or unclear items were removed, and the list was refined to 35 statements.

Here we need to also add two examples of scales which were adapted to measure attitudes on the effectiveness of storytelling in economics education:

1. Advancing Accounting Research of Teaching Efficacy: Developing a Scale to Measure Student Attitudes toward Active Learning Experiences by Burney, Zascavage, and Matherly (2017). This scale measures student attitudes towards active learning experiences. Items adapted on basis of

this scale were “I understand [economic] principles more deeply when they are explained through stories.” and “Using stories in [economics] made the class more interesting. [I find myself more interested in the class when the content is presented as a story.]”

2. Student Classroom Engagement Scale by Nayir (2015). This scale measures student perceptions of their engagement in class. To exemplify, items adapted on basic of this scale were “Stories [in economics] helped me focus on the material” and “[Economics] classes that use stories are more engaging,” re-written as, “Learning through storytelling is more engaging than learning through textbooks.”

### III. Sketch of the Instrument

The initial version of the instrument was created with input from researchers and experts. It comprised 35 statements centred on seven attitudinal parameters: Engagement, Understanding, Retention, Interest, Relevance, Effectiveness, and Adaptability. Each parameter featured five sub-themes, forming a comprehensive set of statements presented in a tabular format. The survey asked respondents to express their agreement with each statement on a 5-point Likert scale, ranging from “Strongly Disagree” to “Strongly Agree.” Pilot testing was conducted with three groups of students (Refer Table 1) to refine the instrument further.

Each group participated in a three-day (9-hour) economics workshop led by the researcher, covering various microeconomic concepts. The pilot survey, containing 35 statements, was administered via Google Forms.

**Table 1: Pilot Testing Groups and Stories Conducted**

Group	Academic Level	Number of Students	Prior Economics Exposure	Stories Conducted <sup>a</sup>
<b>Techno International New Town, Kolkata</b>	First year undergraduate students (B.Tech, BCA, BBA)	91	27 students studied economics in high school	Story A, Story B, Story D
<b>University of Calcutta, Kolkata</b>	First-year postgraduate students (M.Sc. Eco.)	39	N/A	Story C, Story D, Story E
<b>Various Schools in India (Online)</b>	Grade XI (High School) students	43	Most were new to economics	Story A, Story B

a. Story A: What is Economics? Economics is Appreciation and Suggestions; Story B: My Mother is the best Economist: Model “M.O.T.H.E.R.” and Basics Economics; Story C: Taking about Central Problems: There are no problems at all; Story D: Economics in Advertisement: Advertising Economics; Story E: Perfect Competition is a Model: And Everyone Want to be One!

From the initial pilot, data from 153 respondents were collected and analyzed. The demographic profile was not considered at this stage to ensure an unbiased data set, which was then processed using SPSS software. The initial Cronbach's Alpha was

**Table 2: 24 Items TIDE Scale**

THESE ARE SOME PERCEPTIONS REGARDING THE EFFECTIVENESS OF STORYTELLING AS A TOOL FOR TEACHING ECONOMICS	DO YOU AGREE WITH THESE PERCEPTIONS?				
	1	2	3	4	5
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1 I find learning economic concepts through storytelling more interesting than through traditional textbooks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2 Stories make economic concepts more appealing to me than textbook explanations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3 I am more curious about economic topics when they are presented as stories.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4 My interest in economics increases when concepts are taught through storytelling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5 Storytelling makes the learning process more fascinating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6 I can easily apply economic concepts learned through storytelling to different situations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7 Learning through storytelling is more engaging than learning through traditional textbooks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8 I find myself more interested in economic material if it is presented as a story.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9 Storytelling captures my attention better than reading from a textbook.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10 I feel more motivated to learn economics when the content is delivered through stories.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11 I remember economic concepts better when they are presented through storytelling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12 Storytelling aids in retaining complex economic ideas longer than traditional methods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13 Stories make it easier for me to recall economic principles.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14 Compared to textbooks, storytelling enhances my retention of economic concepts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15 I have a better grasp of concepts when they are presented through storytelling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16 Storytelling helps clarify complex economic ideas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17 Economic concepts presented through storytelling feel more relevant to my everyday life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18 Stories make economic principles more applicable to current events and issues.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19 I understand economic principles more deeply when they are explained through stories.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20 Compared to textbooks, storytelling provides clearer explanations of economic concepts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21 Storytelling is the more effective method of learning economic concepts than using textbooks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22 I find that I learn economic concepts more effectively through stories.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23 The effectiveness of my learning increases when content is presented as stories.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24 Storytelling makes it easier to adapt economic principles to real-life contexts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

0.802, indicating good internal consistency (Tvakol & Dennick, 2011). However, some item pairs showed high correlation values ( $|r| > 0.8$ ), suggesting redundancy (Pett, Lackey, & Sullivan, 2003). Through iterative elimination of highly correlated items, the instrument was refined to 24 items, ensuring all attitudinal parameters were adequately represented. The final version is detailed in Table 2.

#### **IV. TIDE: The Indian Dream Economics Scale**

The TIDE Scale was developed to capture students' preferences and learning outcomes when exposed to storytelling in economics. It measures not only engagement but also broader dimensions such as understanding, retention, interest, and adaptability. By integrating narratives from cultural and real-life contexts, TIDE evaluates how effectively storytelling complements or surpasses traditional textbook methods.

Rather than viewing education as memorization, TIDE positions storytelling as a meaningful pedagogy that makes economics accessible and relevant. The scale thus serves as both a measurement instrument and a conceptual framework for understanding how narrative-based teaching enriches economics education.

*The following section reports the validation of the TIDE Scale through factor analysis, establishing its reliability and underlying dimensions.*

#### **V. Validating the Instrument: Factor Analysis Report**

Comrey and Lee (1992) and Pedhazur and Schmelkin (1991) offer general guidelines for what should be included in a report of a factor analysis study. Using these guidelines, we embark on the exploration of 'TIDE Scale' and validating the survey 'instrument.'

##### **1. Theoretical Rationale for the use of Factor Analysis**

The research aims to explore the effectiveness of storytelling in teaching economics by investigating students' perceptions of this method. Rather than focusing solely on hypothesis testing (Pett, Lackey, & Sullivan, 2003), the study seeks to uncover the underlying structure of these perceptions, aiming to develop a narrative framework that makes economic concepts more relatable and accessible to students. The ultimate goal is to design storytelling programs that cater to students' specific learning needs, fostering a deeper understanding of economics and its real-world applications.

To achieve this, the study employs factor analysis, a statistical method that identifies patterns and relationships among variables. This approach helps in

reducing complex data into key components, such as engagement, understanding, and motivation, which influence students' perceptions of storytelling in economics education. By identifying these factors, the research can create an effective narrative framework that addresses the specific learning needs of students, enhancing their comprehension and application of economic concepts.

## 2. Sampling Methods and Participants' Profile

To ensure diversity in economic education across various academic levels and backgrounds, a purposive sampling technique was employed, supplemented by Snowball sampling to build the student base for online storytelling sessions. The survey initially aimed for a sample size of 800 to 1000 participants, but after screening, the effective sample size was reduced to 700, ensuring that each scale item had at least ten participants.

The demographic profile of the 700 respondents (Refer Table 3) reveals a diverse group, with ages ranging from 17 to 25 years (mean age of 19.6). The participants were predominantly Hindu (71.7%), female (50.3%), and from the general social category (60.9%). Most were graduate students (77.9%), with the remaining 22.1%

**Table 3: Demographic Characteristics of the Sample (N = 700)**

<b>Variable</b>	<b>N, Percentage (%)</b>
Age (years) (Mean $\pm$ SD)	19.6 $\pm$ 1.469 $\leq 18$ (224, 32%), $\geq 21$ (226, 32.3%)
Cultural Background	Hindu (502, 71.7%)
Gender	Male (348, 49.7%), Female (352, 50.3%)
Academic Year	$\leq$ XII (155, 22.1%), $\geq$ Graduation (545, 77.9%)
Previous Exposure to Economics Education	Yes (372, 53.1%), No (328, 46.9%)
Medium of Instructions at School	Official (English and/or Hindi) (294, 42%) Regional (406, 58%)
Social Category	General (426, 60.9%)
Family Size (No.) (Mean $\pm$ SD)	4.46 $\pm$ 1.158 $\leq 3$ (175, 25%), $\geq 7$ (44, 6.3%)
Family Socioeconomic Status (Mean $\pm$ SD) (in INR Lacs per annum)	15.98 $\pm$ 9 Low Income Group (315, 45%) High Income Group (95, 13.6%)
Location of School (Ref: Indian States)	East (393, 56%)
Parents' highest Level of Education	$\leq$ XII (288, 41.1%), $\geq$ Graduation (412, 58.9%)
Parents' Current Occupation	Business (293, 41.9%), Others (407, 58.1%)

in class XI or XII. Over half (53.1%) had prior exposure to economics education. The medium of instruction varied, with 42% using official Indian languages (English and/or Hindi) and 58% using regional languages. Family sizes averaged 4.46 members, and socioeconomic status ranged widely, with 45% in the low-income group and 13.6% in the high-income group. Most respondents were from eastern India, especially West Bengal (56%), and parental education was split between those with up to XII education (41.1%) and those with graduate degrees or higher (58.9%). Parental occupations were evenly divided between business (41.9%) and other fields (58.1%).

### ***3. Likert Scale Items' Analysis and Initial Tests of Adequacy***

The items means, standard deviations, and inter-item correlation matrix is presented in Table 4. On a five-point scale, where 1 = strongly disagree to 5 = strongly agree, the means ranged from 3.21 (Item C18: Stories make economics principles more applicable to current events and issues) to 4.55 (Item C19: I understand economic principles more deeply when they are explained through stories), with an overall mean score of 4.08 across all 24 items on the instrument. Examination of the correlation matrix indicated that all items correlated  $\geq |0.30|$  with at least three other items in the matrix (range 3 – 20). Sixteen of the 24 items (66.67%) had 9 or more shared correlations that exceeded  $|0.30|$ . No inter-item correlation exceeded  $r = |0.68|$ , thus indicating no problems with multicollinearity.

Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) measure were used to assess the suitability of the data for factor analysis among the 24 items. Bartlett's Test was significant ( $\chi^2 = 25,892.684$ ,  $p < 0.001$ ), indicating that the correlation matrix was not an identity matrix, and the KMO statistic was 0.894, considered 'meritorious.' These results confirm that the data is appropriate for factor analysis. Item-to-total scale correlations ranged from 0.294 to 0.726, within the acceptable range, and no items were removed for redundancy. The overall Cronbach's alpha for the scale was 0.92, indicating high internal consistency.

### ***4. Factor Extraction and Rotation Methods***

In this work, the factor extraction approach was Principal Component Analysis (PCA), and factor rotation was done using Promax.

Table 4: The 24-Items Mean, Standard Deviation and Inter-Item Correlation Matrix

Correlations

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	M <sup>***</sup>	SD <sup>***</sup>	MSA <sup>***</sup>
C1	1.000																								4.38	0.92	0.82
C2	.676**	1.000																							4.34	0.91	0.89
C3	.684**	.661**	1.000																						4.41	0.89	0.89
C4	.646**	.618**	.629**	1.000																					4.33	0.88	0.94
C5	.636**	.639**	.638**	.631**	1.000																				4.05	1.01	0.96
C6	.250**	.227**	.228**	.268**	.112**	1.000																			4.00	1.04	0.85
C7	.342**	.370**	.336**	.271**	.158**	.074**	1.000																		4.00	1.01	0.91
C8	.187**	.210**	.191**	.140**	.074**	.066**	.677**	1.000																	3.92	0.96	0.95
C9	.466**	.487**	.459**	.400**	.255**	0.052	.687**	.574**	1.000																4.02	1.01	0.90
C10	.076	.097**	.090**	0.050	-0.006	.068**	.675**	.669**	.684**	1.000															3.76	0.86	0.89
C11	.240**	.239**	.276**	.235**	.133**	.352**	.168**	.239**	.084**	.322**	1.000														3.86	0.69	0.84
C12	.251**	.245**	.279**	.229**	.195**	.279**	.206**	.212**	.184**	.250**	.487**	1.000													4.04	1.13	0.92
C13	.257**	.265**	.301**	.227**	.156**	.285**	.217**	.302**	.137**	.383**	.585**	.461**	1.000												3.84	0.61	0.87
C14	.230**	.229**	.238**	.182**	.115**	.184**	.280**	.276**	.260**	.274**	.479**	.452**	.446**	1.000											4.10	1.21	0.89
C15	.427**	.425**	.446**	.394**	.305**	.305**	.443**	.445**	.385**	.350**	.381**	.316**	.452**	.249**	1.000										4.49	0.92	0.90
C16	.450**	.430**	.469**	.420**	.320**	.321**	.434**	.440**	.380**	.338**	.377**	.319**	.446**	.274**	.682**	1.000									4.52	0.92	0.88
C17	.250**	.267**	.260**	.243**	.184**	.272**	.143**	.156**	.140**	.123**	.313**	.182**	.305**	.151**	.259**	.228**	1.000								3.47	1.08	0.88
C18	.198**	.212**	.191**	.225**	.193**	.262**	.086**	.103**	.070**	.068**	.308**	.086**	.238**	.129**	.189**	.179**	.468**	1.000							3.21	0.99	0.79
C19	.403**	.382**	.420**	.371**	.287**	.287**	.398**	.416**	.345**	.318**	.336**	.289**	.416**	.233**	.648**	.666**	.196**	.164**	1.000						4.55	0.87	0.94
C20	.438**	.427**	.458**	.407**	.312**	.313**	.438**	.440**	.383**	.343**	.378**	.318**	.446**	.261**	.691**	.691**	.246**	.184**	.657**	1.000					4.51	0.92	0.89
C21	.124**	.144**	.135**	.104**	0.021	.111**	.608**	.603**	.506**	.643**	.500**	.233**	.362**	.260**	.438**	.429**	.144**	.117**	.415**	.432**	1.000				3.79	0.91	0.89
C22	.311**	.334**	.310**	.241**	.133**	.100**	.655**	.601**	.644**	.596**	.217**	.225**	.242**	.292**	.458**	.452**	.150**	.080**	.429**	.455**	.632**	1.000			4.00	0.99	0.90
C23	.402**	.425**	.395**	.337**	.190**	0.026	.603**	.612**	.649**	.521**	.079**	.185**	.146**	.257**	.403**	.388**	.144**	0.040	.352**	.396**	.639**	.675**	1.000		4.05	1.03	0.90
C24	.188**	.199**	.201**	.222**	.148**	.255**	.114**	.148**	.137**	.203**	.330**	.119**	.315**	.199**	.213**	.209**	.369**	.464**	.183**	.206**	.215**	.121**	.114**	1.000	3.75	0.93	0.86

\*\*\*. M. Mean, SD. Standard Deviation; MSA. Measures of Sampling Adequacy

\*\* . Correlation is significant at the 0.01 level (1-tailed).

\* . Correlation is significant at the 0.05 level (1-tailed).

## 5. *Underlying Assumptions*

Several key assumptions were made in the factor analysis to ensure accurate and reliable results. A sample size of 700 was deemed sufficient for Principal Component Analysis (PCA), supported by a Kaiser-Meyer-Olkin (KMO) measure of 0.894. Linear relationships between variables were assumed, with significant correlations justifying factor analysis, confirmed by Bartlett's sphericity test. Promax rotation was applied, assuming associations between components. Items needed significant loadings on only one factor, with a 0.40 threshold, reflecting distinct constructs. The analysis also assumed interpretability, normalcy in variable distribution, homogeneous variation, and low multicollinearity among variables to identify unique factors effectively.

## 6. *Criteria Involved for Retaining Factors*

Determining the number of factors to retain in factor analysis is crucial for accurate interpretation and utility of the results. This study employed several key criteria to ensure the validity and reliability of the factor analysis. The Kaiser Criterion suggests retaining factors with eigenvalues greater than 1, as they explain more variance than individual variables (Kaiser, 1960). The Scree Test (Cattell, 1966) involves plotting eigenvalues and retaining factors before a significant drop in the slope, known as the "elbow." Additionally, the cumulative percentage of variance explained is considered, with a target of around 60-70% being deemed adequate in social sciences to effectively represent the underlying structure of the data (Hair, 2009).

In our study PCA revealed that 5 factors had eigenvalues greater than 1, indicating their significance (refer Table 5). The Scree test further supported this by showing a clear "elbow" point after the 5th factor, suggesting that these should be retained (refer Figure 1). Additionally, the 5 factors collectively explained 80.683% of the total variance, which is considered satisfactory according to literature standards (refer Table 5).

Based on these criteria we determined that retaining 5 factors was appropriate. These factors were then used to investigate how storytelling impacts key dimensions in economics education, including engagement, effectiveness, interest, understanding, retention, adaptability, and relevance.

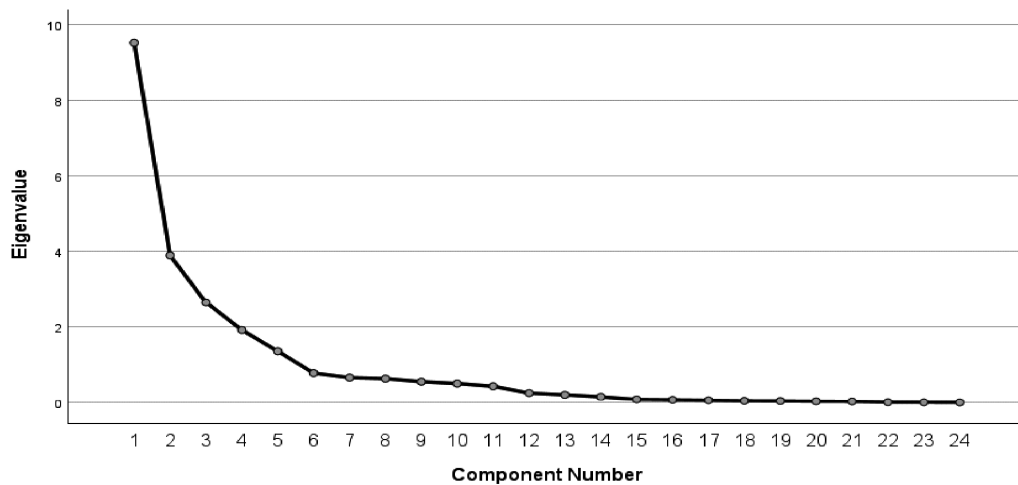


Figure 1: Scree Plot

Table 5: Total Variance Explained by the Five Extracted Factors of the TIDE Scale

Component	Initial Eigenvalues			Extracted Sums of Squares Loading			Rotated Sums of Squares Loading
	Total	% Variance	Cumulative %	Total	% Variance	Cumulative %	Total
I	9.528	39.701	39.701	9.528	39.701	39.701	7.365
II	3.900	16.250	55.951	3.900	16.250	55.951	5.904
III	2.653	11.052	67.003	2.653	11.052	67.003	6.577
IV	1.921	8.003	75.006	1.921	8.003	75.006	4.579
V	1.362	5.677	<b>80.683</b>	1.362	5.677	80.683	3.333

## 7. Descriptions and Interpretations of Factors

The factor analysis process begins by sorting the factor pattern matrix, grouping items with high loadings on a particular factor and suppressing those with low loadings, typically below 0.40, using SPSS. According to Comrey and Lee (1992, p. 241), factor loadings are evaluated based on the percentage of shared variance, with loadings of 0.45 being “fair” and 0.71 considered “excellent.” Items with loadings below 0.30 are generally excluded from defining a factor due to insufficient shared variance. High factor loadings indicate a strong relationship between the item and the factor, making it easier to interpret the factor’s meaning.

Naming factors involves a blend of theoretical insight and intuition, with the item with the highest loading often providing a clue to the factor’s identity. Once a factor is named, this label typically becomes the focus of communication in

research, potentially overshadowing the individual items that define it. Pedhazur and Schmelkin (1991) suggest that if items originally classified together load on the same factor, the name given to that classification might be the most appropriate name for the factor. This process is crucial for accurately interpreting and applying the results of the factor analysis in future research and practical applications.

Table 6 presents the factor structure matrix for TIDE Scale. It includes, the items, the short names for items, and the identification of which of the five factors that the items most strongly loaded ( $> 0.40$ ).

**Table 6: The Loadings of the 24 TIDE Scale items on the Rotated Factor Structure Matrix**

Items	Component				
	1	2	3	4	5
C1 Storytelling Interest	0.289	<b>0.982</b>	0.419	0.275	0.250
C2 Concept Appeal	0.315	<b>0.971</b>	0.404	0.271	0.263
C3 Topic Curiosity	0.290	<b>0.971</b>	0.438	0.310	0.255
C4 Increased Interest	0.230	<b>0.950</b>	0.391	0.249	0.281
C5 Learning Fascination	0.116	<b>0.737</b>	0.302	0.150	0.199
C6 Apply Concepts	0.044	0.220	0.360	0.415	<b>0.469</b>
C7 Storytelling Engagement	<b>0.957</b>	0.325	0.412	0.247	0.120
C8 Material Interest	<b>0.944</b>	0.151	0.431	0.314	0.172
C9 Attention Capture	<b>0.903</b>	0.470	0.345	0.169	0.098
C10 Learning Motivation	<b>0.887</b>	0.026	0.339	0.397	0.190
C11 Better Memory	0.198	0.183	0.401	<b>0.869</b>	0.500
C12 Longer Retention	0.219	0.247	0.320	<b>0.746</b>	0.149
C13 Easier Recall	0.260	0.198	0.475	<b>0.841</b>	0.460
C14 Enhanced Retention	0.299	0.208	0.236	<b>0.720</b>	0.184
C15 Better Grasp	0.439	0.405	<b>0.987</b>	0.429	0.307
C16 Clarify Ideas	0.429	0.424	<b>0.992</b>	0.436	0.291
C17 Everyday Relevance	0.147	0.249	0.245	0.289	<b>0.738</b>
C18 Current Adaptability	0.075	0.195	0.191	0.226	<b>0.816</b>
C19 Deep Understanding	0.400	0.375	<b>0.975</b>	0.392	0.259
C20 Clear Explanations	0.433	0.415	<b>0.992</b>	0.431	0.297
C21 Learning Effectiveness	<b>0.908</b>	0.075	0.432	0.372	0.225
C22 Effective Learning	<b>0.955</b>	0.285	0.437	0.287	0.134
C23 Increased Effectiveness	<b>0.929</b>	0.399	0.357	0.172	0.077
C24 Adapt Principles	0.158	0.173	0.209	0.310	<b>0.757</b>

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

Note: Loadings highlighted in bold indicate the factor on which the item was placed.

The factor analysis identified five distinct factors related to the use of storytelling in economics education. Factor 1, “Effectiveness and Engagement in Learning Methods,” captures themes of how storytelling boosts student engagement and its perceived effectiveness in teaching economics. Factor 2, “Interest in Storytelling for Economics,” focuses on how narrative techniques heighten students’ curiosity

and sustained interest in economic concepts. Factor 3, “Enhancing Understanding in Economics through Storytelling,” highlights the role of storytelling in making complex economic ideas more comprehensible and promoting deeper analysis. Factor 4, “Retention Power of Storytelling in Economics,” examines how storytelling aids in memory retention and recall of economic information, improving long-term learning outcomes. Lastly, Factor 5, “Adaptability and Relevance of Storytelling in Economics,” emphasizes storytelling’s flexibility in applying economic concepts

**Table 7: The 24 TIDE Scale items Loadings (Factor-wise)**

ITEMS	Factors				
	1	2	3	4	5
<b>1. Effectiveness and Engagement in Learning Methods</b>					
C7 Storytelling Engagement	0.943				
C8 Material Interest	0.935				
C22 Effective Learning	0.930				
C23 Increased Effectiveness	0.928				
C10 Learning Motivation	0.906				
C21 Learning Effectiveness	0.895				
C9 Attention Capture	0.893				
<b>2. Interest in Storytelling for Economics</b>					
C1 Storytelling Interest		0.960			
C2 Concept Appeal		0.947			
C3 Topic Curiosity		0.939			
C4 Increased Interest		0.936			
C5 Learning Fascination		0.738			
<b>3. Enhancing Understanding in Economics through Storytelling</b>					
C19 Deep Understanding			0.998		
C20 Clear Explanations			0.979		
C16 Clarify Ideas			0.977		
C15 Better Grasp			0.973		
<b>4. Retention Power of Storytelling in Economics</b>					
C12 Longer Retention				0.819	
C11 Better Memory				0.812	
C14 Enhanced Retention				0.789	
C13 Easier Recall				0.748	
<b>5. Adaptability and Relevance of Storytelling in Economics</b>					
C18 Current Applicability					0.872
C24 Adapt Principles					0.766
C17 Everyday Relevance					0.734
C6 Apply Concepts					0.421

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

Note: Rotation converged in 6 iterations.

to various contexts and its relevance to real-life and contemporary issues. These factors collectively demonstrate the multifaceted impact of storytelling on student engagement, comprehension, and retention in economics education.

To evaluate if our suggested themes were supported, we should examine the factor pattern matrix, as our factor analysis method implied correlation between factors. In an oblique (i.e., correlated) factor analysis solution, the loadings in the factor structure matrix represent straightforward correlations of the items with the factors, whereas the loadings in the factor pattern matrix represent the item's unique relationship with the factor. Table 7 shows the factor pattern matrix for all 24 TIDE Scale components. The factor loadings in this matrix were sorted by size and loadings less than .40 were suppressed. Examining the factor pattern matrix reveals a clear trend among the identified themes.

### 8. Consistency of Sub-Scales (Factors)

While reporting for the consistency among the generated five sub-scales, Hatcher (1994) suggests including simple descriptive statistics (e.g., means and standard deviations) along with the correlation and coefficient alpha reliability estimates. Table 8 presents the means, standard deviations, factor correlation and alpha coefficients for the 5 generated sub-scales of the TIDE scale.

The correlations between the sub scales ranged from 0.14 [for the two sub scales 1: Effectiveness and Engagement and 5: Adaptability and Relevance] to 0.48 [for the two sub scales 3: Understanding and 4: Retention]. The reliability estimates presented in parentheses on the diagonals of Table 8 ranged from 0.70 to 0.99, with a total scale coefficient alpha equal to 0.92.

**Table 8: Factor Correlations and Factor Alpha Coefficients for the TIDE Scale (N = 700)**

Factor	M*	SD	1	2	3	4	5
1. Effectiveness and Engagement (n = 7)	3.93	0.97	(0.97)				
2. Interest (n = 5)	4.30	0.92	0.26	(0.96)			
3. Understanding (n = 4)	4.52	0.91	0.41	0.39	(0.99)		
4. Retention (n = 4)	3.96	0.95	0.29	0.22	0.48	(0.80)	
5. Adaptability and Relevance (n = 4)	3.61	1.01	0.14	0.29	0.32	0.42	(0.70)
Total Scale (n = 24)	4.06	0.95					(0.92)

\*. Range: 1.00 to 5.00

Note: Reliability estimates appear in the parantheses on the diagonal.

Cronbach's alpha values indicate the internal consistency of a scale, with 0.70 or higher considered acceptable, 0.80 or higher as very good, and values above 0.90 as excellent. The results suggest that the extracted subscales in the study demonstrate acceptable to excellent internal consistency, supporting the reliability of the factor structure derived from the analysis.

### ***9. Analysis of Factor Based Scores***

To analyze the relationship between identified factors and respondents' demographic or psychosocial characteristics, researchers can generate composite scores for each discovered factor. These scores can be used in further analysis to examine relationships with continuous variables (e.g., age, socioeconomic status) or differences between subgroups (e.g., gender). Two primary methods for obtaining these composite scores are factor score calculation and factor-based scale creation (Pedhazur & Schmelkin, 1991).

In SPSS, factor scores for each individual are calculated using the regression method, which involves combining standardized item scores (refer Table 10) with the factor/component score coefficient matrix derived from factor analysis (refer Table 9).

After performing the factor analysis, SPSS generates a component matrix that contains the coefficients representing the contribution of each item to the identified factors. To compute the factor scores, SPSS first standardizes the original item scores [mean of 0 and standard deviation of 1, using  $(x - \text{Mean})/SD$ ] to ensure comparability. Using the regression method, these standardized scores are then multiplied by the component coefficient matrix. This involves matrix multiplication where the standardized score matrix (with dimensions of, 700 respondents by 24 items) is multiplied by the component coefficient matrix (24 items by 5 factors), resulting in a factor score matrix (700 respondents by 5 factors). Each row in the resulting matrix represents an individual's scores on the derived factors, which can then be used for further analysis and interpretation. This method ensures that the factor scores accurately reflect the underlying structure identified in the factor analysis, providing a comprehensive measure of the latent constructs.

The following Table 10 shows the factor score calculations for Respondent 1 on Factor 1. Likewise all other factor scores for Respondents (1 – 700) on Factor (1 – 5) are calculated.

**Table 9: Factor Score Coefficient (W) Matrix**

Items	Component				
	1	2	3	4	5
C1	0.004	0.216	-0.002	0.005	-0.011
C2	0.011	0.214	-0.010	0.002	0.000
C3	0.002	0.211	0.002	0.019	-0.014
C4	-0.005	0.211	-0.002	-0.005	0.016
C5	-0.016	0.166	0.009	-0.019	0.008
C6	-0.031	0.005	0.055	0.091	0.157
C7	0.158	0.021	-0.001	-0.021	-0.016
C8	0.156	-0.032	0.017	0.010	0.016
C9	0.151	0.071	-0.027	-0.048	-0.023
C10	0.150	-0.059	-0.009	0.071	0.027
C11	-0.014	-0.021	0.012	0.310	0.094
C12	-0.003	0.020	-0.004	0.304	-0.089
C13	-0.006	-0.023	0.037	0.285	0.070
C14	0.021	0.013	-0.040	0.293	-0.053
C15	0.003	-0.001	0.244	-0.003	0.008
C16	0.000	0.004	0.245	0.003	-0.006
C17	0.003	0.010	0.000	-0.004	0.346
C18	-0.004	-0.001	-0.004	-0.035	0.410
C19	-0.003	-0.005	0.252	-0.010	-0.012
C20	0.001	0.002	0.245	-0.001	0.000
C21	0.148	-0.055	0.021	0.037	0.042
C22	0.156	0.007	0.009	-0.004	-0.013
C23	0.156	0.050	-0.017	-0.046	-0.031
C24	0.009	-0.009	-0.010	0.010	0.362

Extraction Method: Principal Component Analysis.

**Table 10: Standardized Factor Score (F11) for Respondent 1 on Factor 1**

Item	Mean	SD	Actual Score	Standardized Score (z)	Factor 1 Coefficients (W)	Factor Score (Wz)
C1	4.38	0.92	2	-2.598355	0.0038	-0.010
C2	4.34	0.91	2	-2.570900	0.0106	-0.027
C3	4.41	0.89	2	-2.697818	0.0019	-0.005
C4	4.33	0.88	2	-2.636069	-0.0050	0.013
C5	4.05	1.01	2	-2.032682	-0.0158	0.032
C6	4.00	1.04	3	-0.960632	-0.0308	0.030
C7	4.00	1.01	3	-0.983865	0.1581	-0.156
C8	3.92	0.96	3	-0.953143	0.1557	-0.148
C9	4.02	1.01	2	-2.001693	0.1506	-0.302
C10	3.76	0.86	3	-0.879731	0.1505	-0.132
C11	3.86	0.69	3	-1.261502	-0.0142	0.018
C12	4.04	1.13	3	-0.919396	-0.0034	0.003
C13	3.84	0.61	3	-1.378260	-0.0061	0.008
C14	4.10	1.21	3	-0.910923	0.0211	-0.019
C15	4.49	0.92	3	-1.613885	0.0028	-0.004
C16	4.52	0.92	3	-1.648328	-0.0003	0.000
C17	3.47	1.08	3	-0.438288	0.0033	-0.001
C18	3.21	0.99	2	-1.213221	-0.0045	0.005
C19	4.55	0.87	3	-1.778232	-0.0029	0.005
C20	4.51	0.92	3	-1.630868	0.0010	-0.002
C21	3.79	0.91	3	-0.868698	0.1482	-0.129
C22	4.00	0.99	3	-1.010138	0.1555	-0.157
C23	4.05	1.03	2	-1.990901	0.1564	-0.311
C24	3.75	0.93	3	-0.805207	0.0093	-0.007
<b>Factor Score for Respondent 1 on Factor 1</b>						<b>-1.296</b>

Analyzing factor scores involves understanding their distribution, categorizing them into meaningful ranges, and interpreting these ranges to draw inferences about underlying constructs. According to Fabrigar, Wegener, MacCallum, and Strahan (1999), factor scores, derived from exploratory factor analysis (EFA), are crucial for interpreting latent variables in psychological and applied research. Standardizing these scores facilitates comparison and interpretation (Thompson, 2004), while practical guidelines help in computing and using them effectively (DiStefano, Zhu, & Mindrila, 2009). Factor scores play a significant role in clinical assessment, scale revision, and evaluating complex interactions, allowing researchers to assess the impact of interventions, such as storytelling in economics education, and provide actionable insights based on their findings (Reise, Waller, & Comrey, 2000).

The analysis of Factor Scores in storytelling-based economics education reveals varying levels of engagement, interest, understanding, retention, and adaptability among respondents. Factor Score 1 shows a bimodal distribution, with half of the respondents indicating moderate to very high engagement and effectiveness, supporting the potential of storytelling to enhance learning experiences. Factor

**Table 11: Synopsis of Regression Factor Scores for 24 Items TIDE Scale**

	Regression Factor Scores				
	1	2	3	4	5
Skewness	-1.455	-1.681	-2.144	-0.899	-0.121
Minimum Score	-3.34	-4	-4.06	-3.51	-3.33
Maximum Score	1.33	1.03	0.76	1.77	2.45
<b>Labels</b>					
Low (Quartiles 25%)	< -0.44	< -0.39	< -0.50	< -0.50	< -0.63
Moderate (Quartiles 50%)	-0.44 to 0.09	-0.39 to 0.43	-0.50 to 0.50	-0.50 to 0.20	-0.63 to 0.09
High (Quartiles 75%)	0.09 to 0.73	0.43 to 0.73	0.50 to 0.58	0.20 to 0.60	0.09 to 0.66
Very High	≥ 0.73	≥ 0.73	≥ 0.58	≥ 0.60	≥ 0.66

Score 2 reflects significant variability in interest levels, with a need to address individual preferences, especially among those with lower interest. Factor Score 3 highlights moderate to high perceptions of understanding enhancement through storytelling, though some limitations are noted. Factor Score 4 suggests moderate to high levels of retention enhancement, emphasizing the need for further evaluation. Lastly, Factor Score 5 indicates a slight skew toward higher perceived adaptability and relevance, underscoring the importance of assessing storytelling's applicability in diverse educational contexts.

### **10. Analysis of Factor Based Scales**

In addition to regression-based factor scores, factor-based scales were also examined by averaging item responses within each factor. Both approaches yielded highly correlated results, consistent with earlier research (Pett, Lackey, & Sullivan, 2003). Given the stronger precision of regression-based scores, subsequent analyses in this study rely on them. Factor-based scales are therefore reported briefly for completeness but not elaborated further.

### **11. Limitations and Future Directions**

This study, while based on a large sample of 700 students, has limitations that affect the generalizability of its findings. The sample was geographically skewed toward eastern India, with limited representation from other regions, and demographically imbalanced, with most participants being undergraduate and Hindu. Such concentration reduces the diversity of perspectives. The TIDE scale also showed overlaps between factors such as Engagement–Effectiveness and Relevance–Adaptability, suggesting scope for refinement.

Future research should address these constraints by employing more diverse samples across regions, academic levels, and socioeconomic groups. Additional items may be developed to strengthen weaker constructs, especially adaptability and relevance. Longitudinal studies are recommended to test the stability of factor structures over time and capture long-term learning effects of storytelling. Complementary qualitative methods, such as interviews and focus groups, could provide richer insights and help fine-tune the scale. By overcoming these limitations, future work can broaden the applicability of the TIDE scale and further establish storytelling as an effective pedagogy in economics education.

## **VI. Creation of TIDE Index**

### ***1. Rationale Behind Creation of TIDE Index***

Creating an overall effectiveness index by combining factor scores is a recognized method in educational research, facilitating a comprehensive evaluation of complex constructs. Factor analysis helps in identifying distinct dimensions of a construct, which can then be synthesized into a single index to provide a holistic measure of effectiveness. For instance, research by DiStefano, Zhu, and Mindrila (2009) emphasizes the importance of factor scores in creating composite indices to enhance the interpretability and utility of survey data. Additionally, studies such as those by Nunnally and Bernstein (1994) highlight the practice of combining multiple factors into a single index to streamline data analysis and interpretation. This method is particularly beneficial in educational settings, where multifaceted constructs like teaching effectiveness, student engagement, and learning outcomes need to be measured comprehensively. By adopting this approach, our study can offer a more integrated view of the impact of storytelling in economics education, encapsulating various dimensions such as engagement, interest, understanding, retention, and adaptability into a singular, meaningful index.

### ***2. TIDE Index – Theoretical Assumptions***

The Indian Dream Economics (TIDE) Index is a new metric designed to assess the effectiveness of narrative in teaching economics. TIDE is intended to measure the effect of storytelling on student engagement, interest, comprehension, retention, and adaptability in the setting of economics education. The index consists of five elements, each representing a different facet of good storytelling in economics education.

The TIDE index is based on a few theoretical views. According to Vygotsky's Social Constructivist Theory (Vygotsky & Cole, *Mind in society: Development of higher psychological processes*, 1978), storytelling as a teaching tool enables social knowledge production, encouraging involvement, interest, and understanding. Cognitive Load Theory (Sweller, 1988) states that storytelling can assist manage cognitive load by presenting complicated economic concepts in an accessible and orderly manner, hence improving retention and adaptability. According to Kolb's, (2014) experiential learning theory, telling stories makes economic concepts more approachable and applicable to everyday circumstances.

This index is predicated on the following premises: that storytelling is a useful teaching tool for economics; that the five factors found through factor analysis are discrete but related components of effective storytelling in economics instruction; and that engagement, interest, understanding, retention, and adaptability are crucial results of effective teaching.

### ***3. TIDE Index – A Multi-dimensional Construct***

The TIDE index is a multi-dimensional construct consisting of five interrelated factors: Effectiveness and Engagement (Factor 1), which gauges how well storytelling captures students' interest and participation; Interest (Factor 2), reflecting the appeal and relevance of storytelling in economics; Understanding (Factor 3), assessing storytelling's effectiveness in clarifying economic concepts; Retention (Factor 4), evaluating how well storytelling aids memory retention; and Relevance and Adaptability (Factor 5), measuring how storytelling enables the application of economic concepts to real-life situations. These factors are interconnected, with Interest and Engagement closely linked, as stories that spark interest also enhance engagement. Similarly, Understanding and Retention are tied, as clear storytelling improves both comprehension and memory. These foundational elements contribute to Adaptability, illustrating how a strong narrative approach can synergistically enhance learning outcomes and deepen students' understanding of economics.

### ***4. TIDE Index Development Process***

The TIDE index was developed through a systematic and iterative process, combining the five factors identified through factor analysis. The process involved the following steps:

### ***Step 1: Standardization***

To ensure equal weighting and prevent any single factor from dominating the index, each of five factors underwent standardization. For instance, Factor 1 (Effectiveness and Engagement), comprising 7 items, was standardized as follows:

- Percentage participation (PP) of each item was calculated based on its factor loadings as  $PP = \text{Factor Loading} / (\text{Total factor loadings of 7 items})$ .
- The overall Factor 1 score was determined using the weighted sum of its items, based on their respective PP values.
- To normalize the score, the overall Factor 1 score was then divided by maximum possible score of 5, resulting in a standardized score ranging from 0 to 1. This normalization ensures that all factors are on the same scale, allowing for a meaningful combination into the TIDE index (Pappas, et. al., 2023).

The intricacies of the data are preserved by maintaining the proportionate relationships between the standardized scores, which are guaranteed by normalization by the highest possible score of 5. With Likert scale data, where the maximum value indicates the highest degree of agreement or endorsement, this method works especially well. We are able to preserve the relative disparities between scores by normalizing using the maximum value, which makes the TIDE index more precise and comprehensible. Research like that conducted by Boone Jr and Boone, (2012) highlights how crucial it is to have proportionate relationships in Likert scale data in order to retain interpretability. Furthermore, Jamieson's, (2004) study emphasizes the advantages of standardizing Likert scale data in order to enable precise comparisons and analysis across various respondents.

### ***Step 2: Weighting***

The standardized factors were then weighted according to their relative importance in explaining the variance in the data. The weights were determined by the percentage of variance explained by each factor in the factor analysis. For example, if the five factors together explained 81% of the variance, and Factor 1 explained 39% of the variance, the weight of F1 would be calculated as:  $\text{Weight of Factor 1} = (\% \text{ of variance explained by F1}) / (\text{Total \% of variance explained}) = 39 / 81 = 0.48$ .

The weighting scheme ensures that the factors are combined in proportion to their contribution to the overall explanation of the data, providing a more accurate and representative TIDE index.

### *Step 3: Aggregation*

Two alternative approaches were considered for aggregation:

#### *Alternative 1: Additive Approach*

The weighted standardized factor score (WSFS) was calculated by multiplying the standardized factor score (SFS, Step 1) by the corresponding weight (W, Step 2) for each factor, represented by the equation:

$$\text{WSFS} = \text{SFS} \times \text{W}.$$

The TIDE Index was then calculated as:

$$\text{TIDE Index} = \text{WSF}_1\text{S} + \text{WSF}_2\text{S} + \text{WSF}_3\text{S} + \text{WSF}_4\text{S} + \text{WSF}_5\text{S}$$

The additive approach assumed that the factors contribute independently to the overall effectiveness of storytelling in teaching economics. The approach is appropriate when the factors are distinct and non-redundant, and their combined effect is expected to be cumulative.

#### *Alternative 2: Multiplicative Approach*

The weighted standardized factor score (WSFS) was calculated by raising the absolute value standardized factor score (SFS, Step 1) to the power of the corresponding weight (W, Step 2) for each factor, represented by the equation:

$$\text{WSFS} = |\text{SFS}|^{\text{W}}.$$

The TIDE Index was then calculated as:

$$\text{TIDE Index} = (\text{WSF}_1\text{S}) \times (\text{WSF}_2\text{S}) \times (\text{WSF}_3\text{S}) \times (\text{WSF}_4\text{S}) \times (\text{WSF}_5\text{S})$$

The multiplicative approach assumed that the factors interact and influence each other in complex ways, and their combined effect is expected to be synergistic. This approach is appropriate when the factors are interconnected and their relationships are non-linear.

Given that the five factors were extracted from a factor analysis, which revealed an underlying multidimensional construct, we opted to use the multiplicative approach to calculate the TIDE index.

A descriptive comparison between the Additive and Multiplicative models of the TIDE Index, based on 700 observations, reveals that both models produce nearly identical index values, with mean values of 0.8134 for the Additive and 0.8006 for the Multiplicative model. Despite the Multiplicative Index having a slightly higher

standard deviation (1.4204 vs. 1.2877), indicating more variability, both models share the same range (0.2200 to 1.0000). The extremely high correlation coefficient of 0.986 ( $p < 0.001$ ) between the two models confirms a strong linear relationship, suggesting that either model is reliable for measuring the TIDE Index, offering flexibility in methodological choice.

### 5. Interpretation of the Overall Index

To interpret the overall TIDE index for future respondents, we can define specific ranges based on the percentiles and the geometric mean concept used in your multiplicative model (Refer Table 12). These ranges will help categorize the effectiveness levels for new respondents.

For a new respondent entering the system with an overall index of 0.81, we can interpret that, a score of 0.81 falls within the *Moderate Effectiveness* range (0.75 - 0.82). This suggests that the respondent perceives storytelling to be moderately effective in teaching economics. While they recognize some benefits in terms of engagement and understanding, they do not view it as highly or exceptionally impactful.

**Table 12: Ranges on TIDE Index**

Label (Effectiveness Index)	Range Index Points	Inference 1	Inference 2	No. of Respondents in the Sample (N = 700)	
<b>Very Low</b>	0.22 to 0.60	This range indicate a significantly low perception of the effectiveness of storytelling in economics education.	Respondents may not find storytelling to be an impactful method for their engagement and understanding.	72	10.3%
<b>Low</b>	0.61 to 0.74	This range suggests a below-average perception of effectiveness.	Some aspects of storytelling may be appreciated, overall, it is not seen as a highly effective teaching tool by respondents.	103	14.7%
<b>Moderate</b>	0.75 to 0.82	This range indicate a moderate level of effectiveness. This is the median range, where many respondents lie, reflecting a balanced view.	Respondents generally perceive storytelling to be somewhat beneficial, enhancing their engagement and understanding of economics to a fair extent.	167	23.9%
<b>High</b>	0.83 to 0.90	This range denotes a high perception of storytelling's effectiveness.	Respondents find storytelling to be a very effective method for teaching economics, significantly improving their engagement, understanding, and retention.	195	27.9%
<b>Very High</b>	0.91 to 1.00	The highest range indicates an exceptional perception of effectiveness.	Respondents find storytelling to be extremely beneficial in teaching economics, with maximum impact on their engagement and understanding.	163	23.3%

Defining these ranges allows for a clear and structured interpretation of new respondents' scores, facilitating ongoing assessment and validation of the effectiveness of storytelling as a teaching tool in economics education. This approach ensures that individual perceptions are accurately captured and categorized, providing valuable insights for educators and researchers.

## VII. Conclusion

This study developed and validated the TIDE (The Indian Dream Economics) Scale to measure the effectiveness of storytelling in economics education. The scale, refined through rigorous factor analysis, identifies five key dimensions: effectiveness and engagement, interest, understanding, retention, and adaptability/relevance. High reliability ( $\alpha = 0.92$ ) and strong factor structures confirm its robustness.

Findings highlight storytelling's potential to enhance student engagement, comprehension, and long-term retention, making economics more accessible and relatable. By introducing the TIDE Index, the study also provides a holistic measure for evaluating storytelling's overall impact. Beyond methodological contributions, the research demonstrates how narrative-based teaching can bridge the gap between traditional textbook methods and students' evolving learning needs.

The TIDE scale offers educators and curriculum designers a practical tool to integrate storytelling into teaching strategies and to evaluate its effectiveness across diverse learning contexts. Its adaptability to varied educational levels and modes of delivery (including online and blended learning) further enhances its relevance.

In sum, this work establishes a validated instrument and a theoretical framework that position storytelling as a meaningful, research-backed pedagogy in economics. With further refinement and broader application, TIDE can support both scholars and practitioners in advancing student-centred and engaging economics education.

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