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Motivation Scale for Innovation for Secondary Grade Students: Development and Validation

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ABSTRACT

To promote high-quality learning, National Education Policy 2020 suggested the implementation of new and innovative strategies in the classroom. The motivation of students is a crucial aspect of fostering high-quality learning, along with other variables. To gauge students' motivation a scale has been developed and validated. The tool is based on Keller's 1983 ARCS model of innovation. The test-retest method and expert analysis were used to validate the instrument. The instrument's test-retest reliability was determined to be 0.793 and its Cronbach alpha to be 0.785. Before validation, the instrument was undergone rigorous process to wipe out ambiguity and mistakes. Bringing a total of 22 items, the final instrument covers all four dimensions—attention, relevance, confidence, and satisfaction.

Keywords: Motivation, Innovation, e-Pathshala AR, Learning Material, Secondary Students.

INTRODUCTION

The motivation of the students has a significant impact on their learning. According to Cahyani, Listiana, and Larasati (2020), Rochman, and Pertiwi (2020), and Simamora (2020), “external elements including the learning environment, learning time, and instrumental aids had a significant impact on students who lacked motivation”. In this regard, the vision of NEP 2020 "Technology use and integration", states "The technology must be integrated with the teaching-learning process to create a pathway for the students to make India a digitally empowered society and knowledge economy throughout the world. Additionally, people in rural areas of the country may now access education thanks to the integration of ICT”.

Garavaglia (2016), Aris and Turner (1994), highlights that innovation is the end outcome of a creative process in the practical context. The successful introduction of a new idea or technique is how innovation is typically defined (Algharaibeh, 2021; Brewer & Tierney, 2012, p. 15). STEM (curriculum

options in schools: science, technology, English, and mathematics), psychological (cognitive science, theory of multiple intelligences, theory of learning style), and technological (computer-based learning, networked learning, e-learning) are some examples of innovations in some fields that have significantly impacted the entire educational system (Pogolşa, 2016, pp. 4-6). The innovation aims to disrupt bureaucratic procedures and helps to create the connections needed for the resolution of structural and complicated issues in educational institutions (Chechi, Chakarborty and Lakhanpal, 2020; Silva and Oliveira, 2020). In this study, the researcher used augmented reality as a novel teaching tool while attempting to gauge the students' motivation.

Motivation: Meaning and Concept

The term "motivation" is used to describe behaviors; it typically describes what prompts our actions and steers us toward intentional behavior. Motivation has been defined as behavior that is focused on a result or objective, where the level of intensity of the behavior or level of participation can change (Deci and Ryan, 2002; Reeve, 2014). A theoretical concept for describing the beginning, direction, intensity, persistence, and quality of behavior-directed behavior is motivation (Brophy, 2010:3). As an "engine of learning" (Paris & Turner, 1994), motivation affects what, how, and when pupils learn (Schunk & Usher, 2012). Ryan and Deci (2000a, 2000b) asserted that motivated students may complete demanding learning tasks that actively involve them in figuring out how to best support their learning, enjoy them, and serve as examples for others.

John Keller's Model of Motivation

The ARCS model by John Keller provides a framework suitable for teachers, students, and academics to - examine, discuss and develop, implement and assess engaging learning solutions. The ARCS model (Keller 1983) is a motivational design process that includes a synthesis of motivational concepts and theories that are clustered into four categories: attention (A), relevance (R), confidence (C), and satisfaction (S).

Attention	**Relevance**	**Confidence**	**Satisfaction**
A1 Perceptual arousal A2 Inquiry arousal A3 Variability	R1 Goal orientation R2 Motive matching R3 Familiarity	C1 Learning requirements C2 Success opportunities C3 Personal control	S1 Intrinsic reinforcement S2 Extrinsic rewards S3 Equity

Attention : The subdimensions of attention deal with Perceptual Arousal, which means that the innovation must be novel and attract attention, Inquiry Arousal, which deals with attention-getting by posing problems or questions, and Variability, which deals with the use of a variety of methods or media to attract students' attention.

Relevance: According to Goal Orientation, an invention must help achieve a shared objective. The Motive-Matching process focuses on matching the purpose to the needs or motives of the students. The Familiarity subdimension implies that to be effective, the innovation needs to be known and comprehensible to the students.

Confidence: Learning Requirement, one of the subdimensions of the confidence dimension, is concerned with the clarity of expectations for students and the standards for evaluation. According to Success Opportunities, to support successful learning, the innovation must provide the learner with options and worthwhile experiences. The Personal Control subdimension focuses on linking the student's effort or personal capacity to their learning.

Satisfaction: Intrinsic Reinforcement refers to encouraging and supporting the learner's fundamental enjoyment of learning, while Extrinsic Reinforcement means the innovation must provide positive

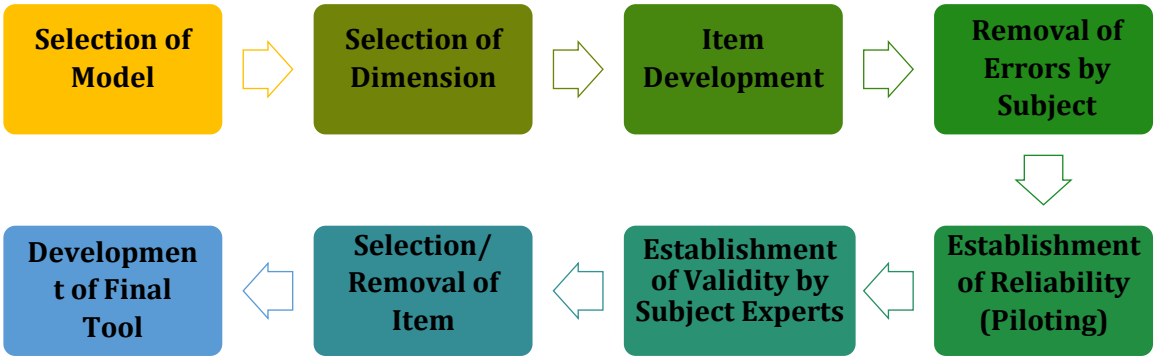
reinforcement and motivational feedback, Extrinsic Reinforcement means the innovation must provide positive reinforcement and motivational feedback to the students, and the Equity subdimension deals with consistency, not just within the parameters of the assignment but also from assignment to assignment.

Motivation For Innovation

The full or partial incorporation of a novel concept or procedure into the real world is considered innovation. Popescu (2022); Dincer (2020), claims that "The term 'innovation' refers to the introduction of something new in a specific subject. The proposed originality, change, creation, transformation, or even invention in the realms of pedagogy and teaching must therefore be seen as an educational innovation". Augmented Reality, or the E-Pathshala AR application, which was used for learning and evaluation, was the innovation taken into account in this study. The participants' willingness to adopt the innovation into their regular practices, the innovation's ability to hold their interest and be relevant to users, as well as how satisfied they are with the innovation after using it, is considered as the motivation for innovation.

Instrument Development Design

The complete process of instrument design and validation followed a systemic and scientific method, as illustrated in the figure below.



Development of the Draft Tool: Motivation Scale for Innovation

Following Keller's four aspects of the ARCS model of motivation, the researcher examined several motivational tools and related articles before creating 52 statements. To ensure that everyone can respond to the statements and that they are relevant to the objectives, the researcher considers grammatical problems, gender-sensitive questions, and equality when creating them. The topic specialists from the schools and the professionals from the Regional Institute of Education, NCERT, Bhubaneswar were then provided the Motivation scale for Innovation (MSI) for preliminary modifications. The draft tool was created after faulty items were fixed or eliminated by specialists and comprises 40 test items, 10 in each dimension.

Validity of the Tool

The test items were subjected to content and construct validity validation by the researcher. During the validation procedure, the printed version of the prototype tool (which includes 52 items) was distributed to eight secondary school subject specialists and two experts from the Regional Institute of Education, NCERT, Bhubaneswar for the removal of the errors and validation of the tool. The defective items are removed (12 items) and the following errors are corrected based on the recommendations of the experts. The second version of the draft tool has 40 items, 10 in each dimension. The experts addressed the following errors:

i. Clarity of sentences, syntax, and grammatical mistakes

ii. Removal of items that are repetitive or inconsistent

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iii. Shortening the length of lengthy items

iv. Correction and elimination of cultural, content, and gender bias.

v. Modifications to items that focus on two aspects/facts/variables

Piloting Process

To carry out a pilot study, the researcher first chose a secondary school where the teaching-learning process was carried out using both ICT and conventional resources. To develop rapport among students, the researcher first seeks permission from the school head and taught the concept structure of atoms to grade 9 students using a smart board. The researcher then introduced the instrument to the students and read over the instructions for answering the test items with them. The researcher provides further information and clears up any confusion about the instrument. The researcher kept the classroom atmosphere natural and completed the test without prejudice. The instrument was administered to all 119 nos. of grade 9 students present on the day in the school.

After a gap of 15-day interval, the researcher retested the instrument on the same sample from the same school to determine reliability. There was no noteworthy known incident that occurred during the gap period that could have influenced the participants' feedback or opinion. During the retest, 98 pieces of data were collected. after the retest process, the researcher chose 78 sample students (i.e., those who took part in the test and retest). The test items' test-retest reliability was determined statistically after a successful administration using the product moment technique of correlation. Those having a reliability equal to or higher than 0.62 and a coefficient of correlation (r) of at least 0.45 were chosen, whereas items with r less than 0.45 were deleted. To establish reliability, the formula 2r/1+r was used to compute the coefficient of reliability. The Cronbach alpha was determined on the dimensions and also on the tool, in addition to the test-retest reliability.

Draft Tool

The subject experts' recommendations were considered while developing the draft tool. The draft tool was developed bilingually, both in English and Odia. The draft tool has a total of 40 items, i.e., 10 items in each dimension, as shown below.

Code	Q. No	Question Attribute	r	S/ D
Attention			0.603	
A1	23	+ve	0.151	D
A2	34	-ve	0.491	S
A3	33	+ve	0.042	D
A4	2	-ve	0.594	S
A5	40	-ve	0.247	D
A6	4	+ve	0.595	S
A7	3	-ve	0.516	S
A8	36	+ve	0.370	D
A9	6	+ve	0.603	S
A10	37	-ve	0.179	D
Relevance			0.443	

Code	Q. No	Question Attribute	r	S/ D
Confidence			0.617	
C1	24	-ve	0.496	S
C2	22	+ve	0.263	D
C3	27	-ve	0.187	D
C4	20	+ve	0.455	S
C5	9	-ve	0.256	D
C6	16	+ve	0.450	S
C7	39	-ve	0.474	S
C8	31	+ve	0.477	S
C9	13	-ve	0.494	S
C10	17	+ve	0.259	D
Satisfaction			0.582	

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R1	35	+ve	0.529	S	S1	26	+ve	-0.059	D
R2	14	+ve	0.460	S	S2	18	-ve	0.049	D
R3	11	+ve	0.219	D	S3	30	+ve	0.286	D
R4	1	-ve	0.463	S	S4	19	+ve	0.223	D
R5	38	-ve	0.125	D	S5	5	-ve	0.564	S
R6	7	-ve	0.264	D	S6	21	+ve	0.508	S
R7	32	+ve	0.496	S	S7	29	+ve	0.515	S
R8	10	-ve	0.452	S	S8	8	+ve	0.196	D
R9	25	-ve	0.292	D	S9	28	-ve	0.464	S
R10	15	+ve	0.463	S	S10	12	-ve	0.470	S

Reliability of the Tool

Items with a correlation r greater than or equal to 0.45 (Reliability = 0.62) were considered (22 items), while the remaining 18 items were discarded. The correlation between the dimensions and with the tool was determined and represented in the following table to establish the instrument's reliability. In addition to the correlation between each dimension and with the entire tool, the Cronbach alpha is likewise calculated and reflected**.**

Correlation Among Variables and Dimensions

Dimension	**Selected Questions (Codes)**	**Correlation**					**No. of Selected Questions**
		A	**R**	**C**	**S**	**Tool**	
Attention (A)	A2, A4, A6, A7, A9	0.603	0.407	0.342	0.443	0.718	5
Relevance (R)	R1, R2, R4, R7, R8, R10		0.443	0.442	0.494	0.773	6
Confidence (C)	C1, C4, C6, C7, C8, C9			0.617	0.478	0.746	6
Satisfaction (S)	S5, S6, S7, S9, S10				0.582	0.799	5
Tool	All above					0.793	22
Cronbach α		0.641	0.686	0.617	0.683	0.785	

According to the above table, the correlation between the dimensions of the MSI was determined to be positive and significant. The overall correlation of the instrument was found to be 0.793, which is both high and significant. However, the Cronbach alpha value of each dimension was found to be in the range of 0.62 to 0.69, owing to the lower number of test items available in each dimension, but the alpha value of the whole instrument was determined to be 0.785, which is significant and acceptable.

Final Instrument

The instrument was again provided to the subject specialists for final approval. Before that it undergone the validation procedure by experts and reliability was established by the test-retest method and Cronbach alpha. The test items were randomly reassembled after the last rectification, and the final instrument was constructed. The letters in the final instrument A stand for agreement, U for uncertainty, and D for disagreement in the following table.

Scoring Procedure

The instrument comprises a total of 22 items, 11 of which are positive statements while the remaining 11 are negative statements. The total of 22 items was then split into four major categories: Attention (A), Relevance (R), Confidence (C), and Satisfaction (S). The following table lists the items' attributes, dimensions, codes, and scoring procedures.

Attribute of Items	Dimensions of the Tool with Item Codes				Scoring		
	Attention (A)	Relevance (R)	Confidence (C)	Satisfaction (S)	A	U	D
Positive	A6, A9	R1, R2, R7, R10	C4, C6, C8,	S6, S7	3	2	1
Negative	A2, A4, A7	R4, R8	C1, C7, C9	S5, S9, S10	1	2	3

Interpretation of the Score

A participant's total score can be obtained by adding all his or her scores from each item. The following table calculates the interpretation of the overall secured score.

Score	22-30	31-39	40-48	49-57	58-66
Interpretation	Very Low	Low	Average	High	Very High

Limitations of the Instrument

The instrument was designed and validated to assess participants' motivation for innovation. The augmented reality application i.e., e-Pathshala AR was used as an innovation for this study. It is based on Keller's ARCS model of motivation from 1983. Because it is a self-developed and self-reporting rating scale, the instrument may not cover all the behavioral traits of the participants.

Applicability or Modification of the Instrument

The instrument is most useful for participants who are studying in schools, secondary schools, or teacher education institutions who have been exposed to an innovative approach to their education or pedagogy of a specific subject. A dimensional analysis of participant motivation is also possible because the instrument categorizes all its items into four major categories: Attention (A), Relevance (R), Confidence (C), and Satisfaction (S). Under the following conditions, the instrument can be modified:

i. Any innovative approach can be used in place of the innovation (here, the e-Pathshala AR app).

ii. The subject (here, Science) can be changed to any subject.

iii. The items or statements can be changed to better suit the innovation/ participants/ situation.

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