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Teacher Educators & Teacher Trainees Awareness and Application towards Bloom's Taxonomy in Thiruvannamalai District

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ABSTRACT

Education plays a vital role in development of any country. In this context, Bloom's taxonomy play a key role in defining learning objectives and assessment of the courses. The purpose of the study is to identify the teacher educators' and teacher trainees' awareness and application towards the Bloom's taxonomy in Thiruvannamalai District, Tamil Nadu. The factors taken for the study are perceived easy of use, perceived usefulness, perceived barriers, adoption of bloom's taxonomy and its effectiveness. The main study of this research was conducted among 150 samples, in which 50 samples includes teacher educators and another 100 samples includes teacher trainees from five different teacher training institutes located at Tiruvannamalai District. The samples were chosen based on Non-Probability sampling (i.e. Quota sampling technique), since few teacher educators and trainees were not shown their interest to respond to the research. The data collected were analyzed through IBM SPSS 24.0 and IBM AMOS 24.0 software package and descriptive statistical analysis and Structural Equation Modeling analysis were performed. The results of study evident that perceived easy of use, perceived usefulness, perceived barriers, adoption of bloom's taxonomy is having impact on perceived effectiveness of Bloom's taxonomy, however teacher educators and Teacher trainees still need more training programmes to be well-versed in this concept in order to minimize the perceived barriers effect on implementation of Bloom's taxonomy, which will improve perceived easy of use, perceived usefulness and its adoption in their teaching learning process effectively.

KEYWORDS
Bloom's taxonomy, Perceived Easy of use, Perceived usefulness, Perceived Barriers, Adoption

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Introduction

India holds an important place in the global education industry. The country has more than 1.4 million schools with over 227 million students enrolled and more than 36,000 higher education institutes. India has one of the largest higher education systems in the world. However, there is still a lot of potential for further development in the education system. India has become the second largest market for e-learning after the US. The sector is currently pegged

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at US$ 2-3 billion, and is expected to touch US$ 40 billion by 2017. The distance education market in India is expected to grow at a Compound Annual Growth Rate (CAGR) of around 34 per cent during 2013-14 to 2017-18. The quality of education rests in the hands of teachers, the teacher training institutes in India take care of developing the teacher resources to meet the present and future demands in the education sectors. Teacher educators are the gurus who train the future teachers. Now-a-days lot of debate is happening about Indian school education system's quality & competency in shaping future manpower of India. In education sector worldwide lot of changes happening in the teaching pedagogics and assessment techniques. One of such development is introduction of Bloom's taxonomy for defining specific learning objectives in different levels. The primary aim of the paper is to identify the teacher educators' and teacher trainees' awareness and application towards the Bloom's taxonomy in Thiruvannamalai District, Tamil Nadu.

Literature Review

This section of the paper summarizes the existing literatures related to the study arranged in latest to the oldest as per year of publication.

John Deal & S Aaron Hegde (2013) *conducted a study on Seinfeld and Economics: How to Achieve the Revised Bloom's Taxonomy in an Introductory Economics Class*. This paper presents an innovative teaching technique, the utilization of a popular sitcom to teach an introductory economics course. Using clips from the television show Seinfeld, instructors can present the oft-perceived difficult, yet basic, economic concepts in an amenable manner, which also enables the achieving of higher levels of learning as per Bloom's taxonomy. A typical assignment based on an episode is provided in the appendix to further help adopt this pedagogical tool.

Martin Valcke., et.al, (2009) conducted a study on supporting active cognitive processing in collaborative groups: The potential of Bloom's taxonomy as a labeling tool. The present study involved 80 third-year university students, enrolled in the educational sciences, in a quasi-experimental study to research the impact of a scripting approach to support their collaborative work in asynchronous online discussion groups. Students in the experimental condition were required to label all their contributions to the discussions using Bloom's taxonomy. The results point at a significant differential impact of this scripting approach: a higher level of cognitive processing was attained and students in the experimental condition mirrored a higher degree of metacognitive regulation in relation to planning, achieving clarity and monitoring.

Nabil Y Razzouk (2008) conducted a study on Analysis" in Teaching with Cases: A Revisit to Bloom's Taxonomy of Learning Objectives. This paper reviews Bloom's taxonomy of learning objectives with a special focus on "analysis." More specifically, the paper seeks to present a more profound perspective of "analysis" and "synthesis" as taught and learned in a typical business course that utilizes case studies. The paper presents a useful framework for analyzing business cases and recommending and implementing viable strategic options.

Hamad Odhabi (2007) conducted a study on impact of laptops on students' learning using Bloom's learning taxonomy. The paper suggested that learning with laptop will provide students with opportunities to develop their knowledge as well as being able to practice what they are learning through the use of educational technology. This can be achieved through the use of educational games and simulation scenarios that take them through similar processes to the real-life situations. Access to local and international networks (Internet) allows students to share their learning experience and get access to the important information related to their study. However, learning with laptops will have a low contribution towards improving feeling or emotional skills required for receiving, responding, valuing, organising and internalising the values of ideas and materials. To improve these skills, the teachers need to explore other methods that may include social and community related activities.

Hansen, John W (2005) conducted a study on Cognitive Styles and Technology-Based education. Cognitive style and brain dominance instruments completed by 56 vocational community college students and 31 industrial technology university students showed that vocational students were more field dependent and had different hemispherical dominance. Dominance also differed between mechanical and electrical specializations. There was a significant relationship between cognitive style and achievement.

Robert Horner, et.al, (2005) conducted a study on how challenging? using bloom's taxonomy to assess learning objectives in a degree completion program. This paper describes the analysis of learning objectives in Philosophy classes in an adult learner degree completion program. The goal of the research was to determine if the level of cognitive challenge in the learning objectives was consistent with the course level. As a result of the study, the school conducted faculty training sessions emphasizing the importance of developing higher level cognitive skills in students by offering appropriate cognitive challenges in the learning objectives and in the course content and assessment associated with those objectives.

Toni Noble (2004) conducted a study on integrating the Revised Bloom's Taxonomy with Multiple Intelligences: A Planning Tool for Curriculum Differentiation. Gardner's theory of multiple intelligences was integrated with the revised Bloom's taxonomy to provide a planning tool for curriculum differentiation. Teachers' progress in using the tool to plan and implement units of work through learning centers was documented over 18 months in two small elementary schools. They reported greater confidence in their ability to broaden their curriculum and cater for different students' strengths across the multiple intelligences and intellectually challenge their students using first the original and then the revised taxonomy. The teachers saw their students as more successful learners as a result of this curriculum differentiation.

Aviles & Christopher B. (2000) conducted a study on Teaching and Testing for Critical Thinking with Bloom's Taxonomy of Educational Objectives. Teaching and testing for critical thinking can be a challenge for new and experienced social work educators because critical thinking has no operational definition. Bloom's Taxonomy of Educational Objectives is a tool from the wider context of education that can help new and experienced social work educators to think more precisely about what it means to teach and test for critical thinking.

Bloom's Taxonomy includes six knowledge levels: knowledge, comprehension, application, analysis, synthesis, and evaluation.

Conceptual Framework of the Study

Bloom's Taxonomy – An overview

Bloom's taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. The three lists cover the learning objectives in cognitive, affective and sensory domains. The cognitive domain list has been the primary focus of most traditional education and is frequently used to structure curriculum learning objectives, assessments and activities. The models were named after Benjamin Bloom, who chaired the committee of educators that devised the taxonomy.

In 1956, Benjamin Bloom along with a group of like-minded educators developed a framework for classifying educational goals and objectives into a hierarchical structure representing different forms and levels of learning. This framework was published as Bloom's Taxonomy of Educational Objectives and consisted of the following three domains:

i. **The Cognitive Domain** – knowledge-based domain, consisting of six levels, encompassing intellectual or thinking skills
ii. **The Affective Domain** – attitudinal-based domain, consisting of five levels, encompassing attitudes and values
iii. **The Psychomotor Domain** – skills-based domain, consisting of six levels, encompassing physicalθ skills or the performance of actions

Each of these three domains consists of a multi-tiered, hierarchical structure for classifying learning according to increasing levels of complexity. In this hierarchical framework, each level of learning is a prerequisite for the next level, i.e., mastery of a given level of learning requires mastery of the previous levels. Consequently, the taxonomy naturally leads to classifications of lower- and higher-order learning. In higher education, the cognitive domain has been the principal focus for developing educational goals and objectives while the affective and psychomotor domains have received less attention. Bloom's taxonomy has stood the test of time, has been used by generations of curriculum planners and college and university professors, and has become the standard for developing frameworks for learning, teaching, and assessment.

Taxonomy of the Cognitive Domain

Bloom's original 1956 Taxonomy of Educational Objectives identified the following levels of cognitive learning (arranged from lower-order to higher-order levels of learning):

i. **Knowledge** – The remembering of previously learned material; this involves the recall of a wide range of material, from specific facts to complete theories.
ii. Comprehension – The ability to grasp the meaning of previously-learned material; this may be demonstrated by translating material from one form to another, interpreting material (explaining or summarizing), or by predicting consequences or effects.

iii. **Application** – The ability to use learned material in new and concrete situations; this may includeθ the application of rules, methods, concepts, principles, laws, and theories.

iv. **Analysis** – The ability to break down material into its component parts so that its organizational structure may be understood; this may include the identification of the parts, analysis of the relationships between parts, and recognition of the organizational principles involved.

v. **Evaluation –** The ability to judge the value of material for a given purpose; the judgments are to be based on definite internal and/or external criteria.

vi. **Synthesis** – The ability to put parts together to form a new whole; this may involve the production of a unique communication (thesis or speech), a plan of operations (research proposal), or a set of abstract relations (scheme for classifying information).

For each level in each domain, Bloom identified a list of suitable verbs for describing that level in written objectives. For each level in the cognitive domain, the following table provides a list of sample verbs to use in writing intended student learning outcomes that are appropriate for that cognitive level of learning. In the table, the learning levels are arranged from lower-order learning to higher-order learning.

The Revised Bloom's Taxonomy

In 2001, a former student of Bloom's, Lorin Anderson, and a group of cognitive psychologists, curriculum theorists and instructional researchers, and testing and assessment specialists published a revision of Bloom's Taxonomy entitled A Taxonomy for Teaching, Learning, and Assessment. The revision updates the taxonomy for the 21st century, and includes significant changes in terminology and structure. In the revised framework, 'action words' or verbs, instead of nouns, are used to label the six cognitive levels, three of the cognitive levels are renamed, and the top two higher-order cognitive levels are interchanged. The result is a more dynamic model for classifying the intellectual processes used by learners in acquiring and using knowledge.

i. **Remembering** – Retrieving, recognizing, and recalling relevant knowledge from long-term memory

ii. **Understanding –** Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining

iii. **Applying** – Using information in new ways; carrying out or using a procedure or process through executing or implementing

iv. **Analyzing** – Breaking material into constituent parts; determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing

v. **Evaluating** – Making judgments based on criteria and standards through checking and critiquing; defending concepts and ideas

vi. **Creating** – Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

Hypothetical Model

This section of the paper discusses formulation of the hypothetical model to verify the factors influencing the perception of effectiveness of Bloom taxonomy. The factors taken for the study are perceived easy of use, perceived usefulness, perceived barriers, adoption of bloom's taxonomy and its effectiveness.

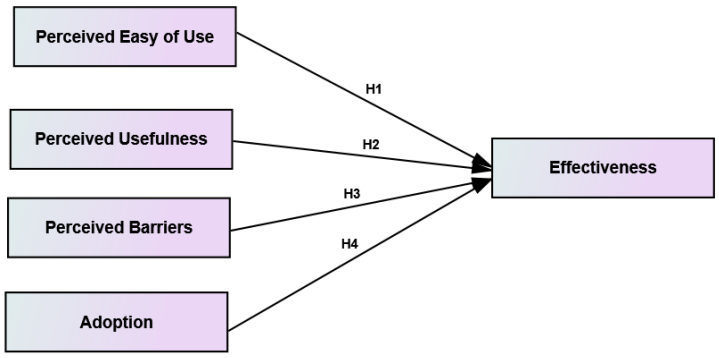

Figure 1. Hypothetical model of the research

Figure 1 represents the hypothetical model to be verified through Structural Equation Modeling approach. Each arrow in the model represents hypothetical relationships named as H1, H2, H3 and H4.

Based on the above model following hypothesis can be formed:

H1: Perceived easy of use is having positive impact on effectiveness of Bloom's taxonomy.

H2: Perceived Usefulness of use is having positive impact on effectiveness of Bloom's taxonomy.

H3: Perceived barriers is having negative impact on effectiveness of Bloom's taxonomy.

H4: Adoption is having positive impact on effectiveness of Bloom's taxonomy.

Methods & Samples

This study followed exploratory research design, in order to explore the teacher educators' & teacher trainees' awareness and application towards bloom's taxonomy in Thiruvannamalai district. The primary data related to the study was gathered through Self-developed Questionnaire. The pilot study was conducted among ten teacher educators and ten teacher trainees from five different teacher training institutes in Tiruvannamalai District. The reliability and validity of the questionnaire was verified based on pilot study results. The content validity of the questionnaire was verified by the expert panel which consists three senior academicians and two Outcome Based Education (OBE) trainers.

Table 1. Scale, variables and Reliability

S. No	Constructs	No. of Variables	Cronbach Alpha Coefficient
1	Perceived Easy of use	5	0.723
2	Perceived Usefulness	5	0.812
3	Perceived Barriers	5	0.861
4	Adoption of Bloom's taxonomy	5	0.925
5	Effectiveness of Bloom's taxonomy	5	0.798

The results of reliability test revealed that all the scales of the questionnaires were having reliability Cronbach alpha coefficient more than 0.7, which indicates its acceptability. The main study of this research was conducted among 150 samples, in which 50 samples includes teacher educators and another 100 samples includes teacher trainees from five different teacher training institutes located at Tiruvannamalai District. The samples were chosen based on Non-Probability sampling (i.e. Quota sampling technique), since few teacher educators and trainees were not shown their interest to respond to the research. The data collected were analyzed through IBM SPSS 24.0 and IBM AMOS 24.0 software package and descriptive statistical analysis and Structural Equation Modeling analysis were performed.

Results & Discussion

This section of the paper discusses the results of the analysis and its inferences.

Descriptive Statistical Analysis

Table 2. Descriptive Statistics- Awareness and adoption of Bloom's Taxonomy

Factors	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
								Statistic	Std. Error	Statistic	Std. Error
Perceived Easy of Use	175	14.00	11.00	25.00	19.44	4.556	20.766	0.131	0.184	-1.229	0.365
Perceived Usefulness	175	15.00	10.00	25.00	20.9	3.339	18.835	0.113	0.184	-1.121	0.365
Perceived Barriers	175	20.00	5.00	25.00	11.57	5.574	20.924	0.010	0.184	-1.191	0.365
Adoption	175	10.00	15.00	25.00	18.72	2.379	19.177	-0.031	0.184	-1.164	0.365

Effectiveness	175	8.00	16.00	24.00	19.80	3.550	20.709	0.031	0.184	-1.193	0.365
Valid N (listwise)	175										

Table 2 condenses the descriptive statistics of the study with range, minimum, maximum, mean, standard deviation, variance, skewness, and kurtosis. From the table, it is perceived that the teacher educators' and teacher trainees perceived more than moderate level of perception towards perceived easy of use, perceived usefulness, adoption and effectiveness of bloom's taxonomy, whereas they perceived less than moderate level of perceived barriers.

Structural Equation Modeling (SEM)

The Structural Equation Modeling approach was used to test the teacher educators & teacher trainees awareness and application towards bloom's taxonomy in Thiruvannamalai district. The Figure 2 and 3 presents the computed estimates of **" Structural Equation Model" .**

The structural equation model shown in Figure 2& 3 has been developed based on the hypothetical model presented in Figure 1.

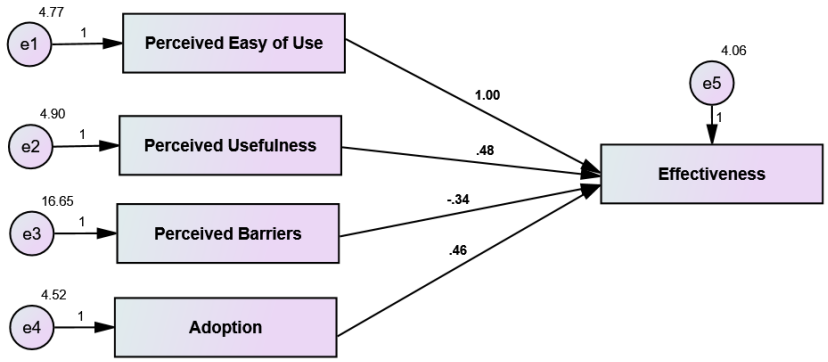

Figure 2. SEM Model based on Unstandardized estimates

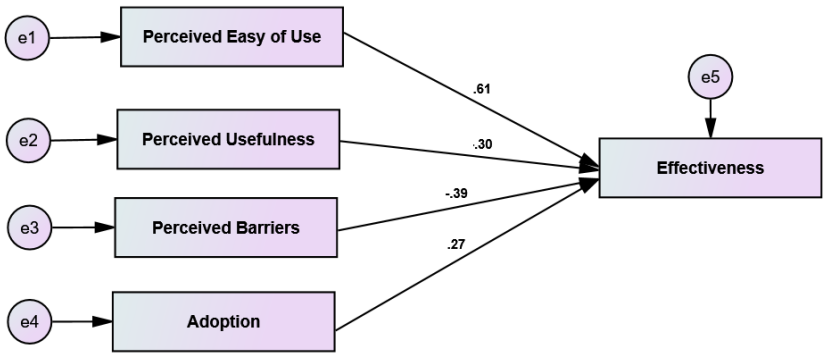

Figure 3. SEM Model based on Standardized estimates

Figure 2 and 3 represents the SEM model based on unstandardized and Standardized coefficients respectively. Table 3 condenses the Unstandardized and Standardized Regression weights of the above mentioned SEM model.

Table 3. Unstandardized and Standardized Regression weights

Measured Variables		Latent Variable	Unstandardized Estimate	S.E.	Standardized Estimate	C.R.	P value
Effectiveness	<---	Perceived Easy of Use	1.000	-	0.608	-	-
Effectiveness	<---	Perceived Usefulness	0.484	0.069	0.298	7.023	<0.001**
Effectiveness	<---	Perceived Barriers	-0.345	0.037	-0.391	-9.210	<0.001**
Effectiveness	<---	Adoption	0.463	0.072	0.274	6.440	<0.001**

Note: ** Denotes significant at 1% level

The Unstandardized regression coefficient value for Perceived Easy of use is 1.000 which represents same effect over perceived effectiveness of Bloom's taxonomy holding the other variables as constant. The positive sign of the estimate represents that effectiveness would increase by 1.000 for every unit increase in Perceived Easy of use and this coefficient value is not significant at 1% level.

The Unstandardized regression coefficient value for Perceived Usefulness is 0.484 which represents partial effect over perceived effectiveness of Bloom's taxonomy holding the other variables as constant. The positive sign of the estimate represents that effectiveness would increase by 0.484 for every unit increase in Perceived Usefulness and this coefficient value is significant at 1% level.

The Unstandardized regression coefficient value for Perceived Barriers is -0.345 which represents effect over perceived effectiveness of Bloom's taxonomy holding the other variables as constant. The negative sign of the estimate represents that effectiveness would decrease by 0.345 (34%) for every unit increase in Perceived Barriers and this coefficient value is significant at 1% level.

The Unstandardized regression coefficient value for Adoption of Bloom's taxonomy is 0.463 which represents partial effect over perceived effectiveness of Bloom's taxonomy holding the other variables as constant. The positive sign of the estimate represents that effectiveness would increase by 0.463 for every unit increase in Adoption of Bloom's taxonomy and this coefficient value is significant at 1% level.

Table 4. Model Fitness Abstract

S. No	Model Fitness Indices	Suggested Values	Value
1	CMIN or Chi Square Value	Range from as high as 5.0 (Wheaton et al, 1977) to as low as 2.0 (Tabachnick and Fidell, 2007).	3.134
2	Significance value (p value)	> 0.05 (Hair et al. 1998)	0.107
3	RMR (Root Mean Square Residuals)	< 0.08 (Hair et al. 2006)	0.033
4	RMSEA (Root Mean Square Error of Approximation)	< 0.08 (Hair et al. 2006)	0.027
5	CFI (Comparative Fit Index)	> 0.90 (Hu and Bentler, 1998)	0.902
6	GFI (Goodness of Fit Index))	> 0.90(Hair et al. 2006)	0.913
7	AGFI (adjusted Goodness of Fit Index)	> 0.90 (Daire et al. 2008)	0.959

(Source: Primary Data)

Table 4 presents the value of Chi-square is 3.134 (which falls in between 2 and 5) shows perfect fit, whereas the significance value is 0.107 (more than 0.05) describes good fit. It is found that RMR is 0.033 and RMSEA value is 0.027 which is less than 0.08 which specifies a good fit. Here CFI (0.902), GFI (0.913), and AGFI (0.959) values are greater than 0.9 which implies good fit. Hence it is proved that perceived easy of use, perceived usefulness, perceived barriers, adoption of bloom's taxonomy is having impact on perceived effectiveness of Bloom's taxonomy.

Conclusion

Bloom's taxonomy is an important milestone in education industry which facilitate defining the learning objectives, and assessment of Outcome Based Education (OBE). It gives clarity to the teacher and the student what sort of learning is expected out of each lesson or course. The results of study evident that perceived easy of use, perceived usefulness, perceived barriers, adoption of bloom's taxonomy is having impact on perceived effectiveness of Bloom's taxonomy, however teacher educators and Teacher trainees still need more training programmes to be well-versed in this concept in order to minimize the perceived barriers effect on implementation of Bloom's taxonomy, which will improve perceived easy of use, perceived usefulness and its adoption in their teaching learning process effectively.

Disclosure statement

No potential conflict of interest was reported by the authors.

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