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# Relationship between Theoretical Knowledge and Application Abilities of Science Teachers in Assessment Practices at School Level

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## Abstract

*The objective was to test the hypothesis that there is no relationship between theoretical knowledge and its practical application in assessment practices used by science teachers in the classroom and in general at the school level. The nature of the study was quantitative with descriptive correlational and linear regression design. The sample was randomly taken for the survey questionnaire from the Principals of high and higher secondary schools in two districts of Pakistan. The result revealed that there is a strong positive relationship between theoretical knowledge and its practical application in assessment used by science teachers at the secondary level. The regression analysis also showed that the theoretical understanding of assessment has a strong impact on the hands-on practices of the assessment. It was recommended that the science teachers' training focus on both theoretical concepts and learning along with the practical application of the assessment practices for effective and quality instructions or pedagogy.*

**Keywords:** Assessment Theory, Assessment Practice, Different Tools and Techniques of Assessment, Science Teachers Training, Assessment Literacy of Science Teachers

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**Contents**



## Title

# Relationship between Theoretical Knowledge and Application Abilities of Science Teachers in Assessment Practices at School Level

## Abstract

*The objective was to test the hypothesis that there is no relationship between theoretical knowledge and its practical application in assessment practices used by science teachers in the classroom and in general at the school level. The nature of the study was quantitative with descriptive correlational and linear regression design. The sample was randomly taken for the survey questionnaire from the Principals of high and higher secondary schools in two districts of Pakistan. The result revealed that there is a strong positive relationship between theoretical knowledge and its practical application in assessment used by science teachers at the secondary level. The regression analysis also showed that the theoretical understanding of assessment has a strong impact on the hands-on practices of the assessment. It was recommended that the science teachers' training focus on both theoretical concepts of learning along with the practical application of the assessment practices for effective and quality instructions or pedagogy.*

**Keywords:** Assessment Theory, Assessment Practice, Different Tools and Techniques of Assessment, Science Teachers Training, Assessment Literacy of Science Teachers

## Introduction

The relationship between theoretical knowledge understanding and practical application of knowledge in performance had a key consideration in many fields such as education, health, nursing, business, sciences, computing, and technologies (Katajavuori, *et al.*, 2006); because: i) Theoretical knowledge provides frameworks for understanding complex systems, principles, and guidelines that can be applied in practical doing and performing a practice (Ven & Johnson, 2006; Jefferies, *et al.*,2024). ii) Theories often predict outcomes, helping practitioners

anticipate results and make informed decisions about a process and products (Nilsen, 2015). iii) New theories can lead to innovations (Mazey, *et al.*, 2023). iv) Practical application of knowledge is a way to test the validity of a theory (Lomborg, *et al.*, 2013). v) Practical challenges can lead to refinements or even the rejection of existing theories, (Gopala, 2023). In essence, theory provides the foundation and direction, practice tests, refines, and sometimes challenges theoretical concepts, leading to growth and evolution in both domains of cognition and psychomotor (Fantinelli, *et al.*, 2024; Lomborg, *et al.*, 2013) along with developing scientific attitude and interest.

Pedagogical theories, such as constructivism, behaviorism, and cognitivism guide the development of curricula, instructional strategies, and assessment methods (Jabsheh, 2024). Vygotsky's social constructivism prioritizes collaborative learning and scaffolding to support student development. Classroom experience allows educators to test and refine pedagogical theories with their action research. Teachers can see which approaches work best with their students and under what circumstances. The observations and experiences from practice can lead to the evolution of pedagogical theories (Saleem *et al.*, 2021) and changes in assessment and evaluation practices.

The theories of learning, pedagogy, and assessment may not always translate perfectly into practice due to differences in context; a theoretical application that works well in one setting might not be as effective in another. Theories provide the foundation for understanding how learning, teaching, and assessment occur and inform the design of effective learning and assessment experiences. In turn, practical application and real-world experiences test, refine, and sometimes challenge these theories or knowledge, leading to continuous growth and adaptation in both learning and assessment theories and practices. This interplay is crucial for creating teaching and learning environments that are responsive to the diverse needs of learners and the ever-changing landscape of education, learning, and assessment (Hiebert & Stigler, 2023).

Keeping in view the context of learning, pedagogy, and assessment or evaluation as basic components of teaching-the learning process all depends on certain theories to be learned during teacher training programs for practical application in classroom teaching. The general observation of the researchers tells us that most science teachers do not follow the proper theoretical (knowledge) and practical (skill or performance competence) components in their actual classroom assessment or evaluation processes and in general at the school level, what they mastered during their teacher's training and professional development programs. On the basis of the literature cited and the researchers' observation, it was intended to study the relationship between theoretical knowledge and hands-on practical application abilities of science teachers in assessment practices at the classroom and school level in general.

## Statement of the Problem

As discussed in the introduction the researchers have observed that there is a strong relationship between the theoretical understanding (knowledge) and practical application (practice) of the classroom assessment practices as those having a good understanding of theory were also good in their practice and vice versa. The problem was stated as: "Relationship between theoretical knowledge and Application Abilities of Science Teachers in Classroom Assessment." The main objective of the study was to find the relationship between theoretical knowledge and practical hands-on abilities of science teachers in assessment in the classroom and school. The following hypotheses were tested:

H01: There is no correlation between theoretical knowledge and practical hands-on application ability of science teachers in assessment at classroom and school level.

H02: There is no impact of theoretical knowledge in assessment over the practical hands-on application ability of science teachers in assessment at the classroom and school level.

## Methodology of the study

The nature of the study was quantitative with descriptive correlational and linear regression design. The sample of school principals (n=38) for the survey questionnaire was taken from two districts of Malakand division (Swat and Malakand) with simple random techniques. The sampled high and higher secondary school principals were surveyed through a self-made Likert scale questionnaire; delivered through personal contacts and registered posts. The collected data were analyzed through SPSS version 26 and the hypothesis was tested through statistical formulae for Pearson's correlation and linear regression with significance $P < 0.05$. On the basis of data analysis findings were drawn and discussed in the light of relevant literature; on the basis of findings and discussion, the recommendations were made for science teachers' training in Assessment theory and

assessment practices in science subjects at the secondary level in Khyber Pakhtunkhwa, Pakistan for making science teaching effective, efficient and qualitative.

## Literature Review

Assessment or evaluation theories provide the foundation for designing, implementing, and interpreting assessments, while practical application tests and refines these theories (Khan, 2012). Theories of assessment, such as formative and summative assessment, criterion-referenced and norm-referenced evaluation, and construct validity, guide the design and implementation of assessments (Black &Wiliam, 2009). Theoretical knowledge of validity and reliability is crucial in developing assessments that are fair, accurate, and meaningful. Theoretical understanding of theories such as Bloom's Taxonomy, multiple intelligences, and cognitive load theory inform the design of assessments that measure not only knowledge recall but also higher-order thinking skills, problem-solving, and creativity.

Educators and teachers often engage in action research, where they systematically investigate their own assessment practices to improve student outcomes. This process not only refines practice but also contributes to the evolution of assessment or evaluation theories (Brookhart, 2004). The integration of technology in assessment is informed by both theory and practice. Theories of digital learning and assessment guide the development of these tools, while practical use provides feedback that leads to their refinement and improvement (Lim, *et al.*, 2024). The ongoing interaction between theory and practice leads to the continuous improvement of both, ultimately enhancing the effectiveness of assessments (James, 2006).

Pakistani's education policies and curriculum guidelines emphasize formative assessment, continuous evaluation, and student-centered learning. Despite the policies in Pakistan, practical implementation is hampered by outdated examination systems, a focus on summative assessments (like final exams), and rote learning. Teachers often prioritize high-stakes exams over continuous assessments due to pressure from education boards, educational departments, and societal expectations (Farooq, *et al.*, 2019).

Teacher training programs in Pakistan include modules on modern assessment techniques, emphasizing formative assessments, feedback mechanisms, and diverse evaluation strategies. Many teachers, particularly in rural areas, lack access to ongoing professional development. They may not be adequately equipped to implement these modern assessment techniques in their classrooms. Many schools, especially in rural or underfunded areas, face significant resource constraints. Limited access to technology, insufficient teaching materials, and large class sizes make it difficult for teachers to implement continuous and varied alternative assessment strategies (Black & Wiliam, 2009).

Teachers are expected to be literate in various assessment methodologies, understanding how to design, administer, and interpret different types of assessments. In practice, many teachers have limited assessment literacy. They may struggle with designing effective formative assessments or providing meaningful feedback, often due to inadequate training and support (Khadijeh & Amir, 2015) Modern educational theories advocate for assessments that support student learning, encourage critical thinking, and are inclusive of diverse learning styles with support of using modern tools and technologies. Societal pressure for high grades and a strong emphasis on exam results can lead to a narrow focus on achieving high marks rather than fostering genuine understanding and skills development. This cultural mindset often undermines the implementation of more holistic assessment practices (Chander & Arora, 2021).

Policies at the national and provincial levels support comprehensive assessment strategies, including formative and summative assessments. There is often a gap in the enforcement of these policies. Schools and teachers may not fully adhere to the guidelines due to lack of oversight, insufficient training, or resistance to change from traditional practices (Looney, 2011). So, by encouraging assessment and evaluation practices that involve engaging students in the assessment process, promoting self-assessment, peer assessment, and critical thinking skills. Addressing these areas in assessment practices can help align classroom assessment practices in Pakistan more closely with the theoretical frameworks intended to enhance Student Learning Outcomes (Farooq, *et al.*, 2019; Hussain, *et al.*, 2019 & Khursheed & Alwi, 2023). Hence, the study is intended to find the relationship between theoretical knowledge understanding and practical performance ability at the secondary level and to assess the training needs of science teachers in assessment practices.

## Data Analysis

### Table 1

*Correlation of theoretical knowledge and application abilities of Science teachers in assessment in views of school principal (n=38)*

| Theme Number | Theoretical Knowledge | Application Ability | Correlation coefficient ( Significance at P <0.05) |
|---|---|---|---|
| Theme 1: Concept of Assessment and types of assessment | Theoretically, science teachers understand the concept of "Assessment for learning, assessment of learning, and assessment as learning and the different types of assessment" used at the secondary level. | Practically, science teachers can apply different assessment types such as formative, summative, and diagnostic for the effectiveness of teaching teaching-learning process. | 0.976** |
| Theme 2: Types of Classroom Assessment Practices | Theoretically, science teachers understand the concept of "Classroom Assessment Practices in science subjects at the secondary level" for improvement and feedback. | Practically, science teachers are able to apply different classroom assessment practices for different purposes such as quizzes, written assignments, oral discussions, portfolios, etc. for the effectiveness of the teaching-learning process through feedback from | 0.952** |
| Theme 3: Students' Learning Outcomes (SLOs) in Science subjects at secondary level | Theoretically, science teachers understand the concept of " Students' Learning Outcomes (SLOs) in Science subjects at secondary level" as mentioned in the curriculum document, 2006. | Practically, science teachers can apply SLOs in classroom assessment practices and prepare the students for SLOs-based exams both internally at school and externally at the BISE level in order to make the teaching-learning process standard-based and qualitative. | 0.960** |
| Theme 4:Tools and Instruments for SLOs based Assessment in Science Subjects at the Secondary Level | Theoretically, science teachers understand the concept of "Tools and Instruments for measurement and SLOs based assessment in Science | Practically, science teachers can apply different tools and instruments for collecting valid, reliable, and authentic data through SLOs-based paper settings for | 0 .968** |

| Theme Number | Theoretical Knowledge | Application Ability | Correlation coefficient ( Significance at P <0.05) |
|---|---|---|---|
| | subjects at secondary level" for fair, valid, and reliable as well as authentic paper settings in classrooms, schools, and institutions. | classroom, school, and board-level examinations. | |
| Theme 5: Construction of test items and tasks for testing, examination, and evaluation on the basis of Bloom's Taxonomy and curricular as well as course objectives | Theoretically, science teachers understand the concept of "Construction of test items and tasks for testing, examination, and evaluation on the basis of Bloom's Taxonomy and SLOs" for fair, valid, and reliable assessment practices in the classroom, and school. | Practically, the science teachers are competent enough to construct test items and tasks for testing, examination, and evaluation on the basis of Bloom's Taxonomy and SLOs " in both internal and external or Board level examinations. | 0.958** |
| Theme 6: Paper setting, checking, scoring, and Rubric development for Objective Marking | Theoretically, science teachers understand the concept of " Paper setting, checking, scoring, and Rubric development" for objective marking of papers in internal and external examinations. | Practically, the science teachers are to apply the concepts of " Paper setting, paper checking, scoring, and Rubric development" for objective marking in examinations internally at school and externally at the board level. | 0. .957** |
| Theme 7: Reporting Results and sharing the assessment, examination, and evaluation data with the Stakeholders | Theoretically, science teachers understand the concept of "Reporting Results and sharing the assessment, examination, and evaluation data with the stakeholders" for improvement, development, and accountability of the persons and system. | Practically, science teachers can apply the concept of "Reporting Results and sharing the assessment and evaluation data with the stakeholders" for improvement, development, innovation, and accountability of the persons and system to make the teaching effective. | 0.950** |
| Theme 8: Ensuring Secrecy, Privacy, Confidentiality, Transparency and Credibility in students' | Theoretically, science teachers understand the concept of "Ensuring Secrecy, Privacy, | Practically, science teachers can apply the concept of "Ensuring Secrecy, Privacy, Confidentiality, | |

| Theme Number | Theoretical Knowledge | Application Ability | Correlation coefficient ( Significance at P <0.05) |
|---|---|---|---|
| assessment, examination and evaluation data | Confidentiality, Transparency and Credibility in students' assessment, examination evaluation data" for fair, valid, reliable, and authentic assessment practices. | Transparency and Credibility in students' assessment, examination, and evaluation data" for improvement, development, and innovation to make teaching. | 0.984** |

*** Correlation is significant at the P<0.05*

Table 1 shows that there is a significantly strong positive Pearson's correlation (r = +0.976, + 0.952, + 0.960, + 0 .968, + 0.958, + 0.957, + 0.950 & +0.984) for themes: 1,2,3,4,5,6.7 & 8 respectively. Hence, we interpret that there is a strong positive correlation between theoretical Knowledge and practical abilities of science teachers in classroom assessment.

**Table 2**

*The impact of science teachers' Theoretical Knowledge in assessment on their hands-on practical abilities in classroom assessment in views of school principals (n=38)*

| Variable in Assessment | Mean | SD | Pearson's Correlation | R square | B | df | F | Significance at P < 0.05 |
|---|---|---|---|---|---|---|---|---|
| Theoretical Knowledge (I.V) | 3.5625 | 1.0224 | 0.981 | 0.962 | 0.981 | 1 | 904.920 | 0.024 |
| Practical Application (D.V) | 3.4737 | 1.049 | | | | | | |

The above table 2 shows the significant relationship between one independent variable i.e. theoretical knowledge and one dependent variable i.e. practical application of assessment practices. The independent variable positively contributes coefficients in defining the regression model for the practical assessment ability or competence. This shows that a high level of theoretical knowledge results in an increase in practical application in classroom assessment practices. The independent variable (predictor) contributes with a regression coefficient value of 0.981 at $p < 0.024$ in defining the Science teachers' ability. Thus, it can be analyzed that the theoretical knowledge of science teachers directly and positively influences their practical application in classroom assessment. The value of the regression slope (0.981) indicates that when the value of an independent variable (theoretical knowledge) is high, then the dependent variable (practical application) would be high. Thus, if theoretical knowledge changes by as much as 1%, it will affect practical application by 0.981%.

## Findings and Results

1. There is a strong relationship between theoretical knowledge and the practical application ability of science teachers for classroom assessment practices at the secondary level (Table 1). Hence, the null hypothesis H01 is rejected.
2. There is a high impact of science teachers' theoretical knowledge on their hands-on abilities in classroom assessment (Table 2). Hence, the null hypothesis H02 is rejected.

## Conclusion

On the basis of the findings and results, it was concluded that there is a positive relationship between theoretical knowledge and practical ability of science teachers in assessment at the classroom and school level and the theoretical knowledge of the assessment significantly affects the science teachers' hands-on practical application of assessment knowledge (Findings 1&2).

## Recommendations

On the basis of findings, results, and conclusion it is recommended that the science teachers be provided with both theoretical and practical components of assessment pieces of training in in-service, pre-service, and induction pieces of training programs.

## Further Research

It is suggested for further research that the research study may be conducted on a large scale throughout the country to make the generalizations valid and reliable.

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