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Exploring the relationship between teachers' instructional approaches and online teaching effectiveness: An *ex-post facto* study in PJT Agricultural University

¹Soujanya Kotte, ²Madhu Babu K, ³Venu Gopala Reddy CH, ⁴Malla Reddy M and ⁵Srinivasa Chary D

¹Ph.D. (Ag.) Scholar, Department of Agricultural Extension Education, College of Agriculture, Rajendranagar, PJTAU, Hyderabad, Telangana, India

²Professor, Extension Education Institution, PJTAU, Rajendranagar, Hyderabad, Telangana, India

³Professor and Dean of Student Affairs, Administrative office, PJTAU, Rajendranagar, Hyderabad, Telangana, India

⁴Professor and Controller of examinations, Administrative office, PJTAU, Rajendranagar, Hyderabad, Telangana, India

⁵Associate Professor, Department of Statistics and Mathematics, College of Agriculture, Rajendranagar, PJTAU, Hyderabad, Telangana, India

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Corresponding Author: Soujanya Kotte

Abstract

The rapid transition to online teaching-learning methods during the COVID-19 pandemic significantly altered the delivery of higher education across disciplines, including agricultural education. This study was conducted at Professor Jayashankar Telangana Agricultural University (PJTAU) to assess the effectiveness of online teaching-learning processes and examine how teacher-related factors influence overall teaching-learning effectiveness. The research adopted an *ex-post facto* research design, collecting data through a structured questionnaire administered to teaching faculty. The effectiveness of online teaching-learning was assessed using seven key indicators: teaching competencies, student readiness, academic resources, curriculum adaptability, student engagement, work environment distractions, and teacher satisfaction. Based on these indicators, respondents were classified into less effective, moderately effective, and highly effective categories. Results indicated that 53.75% of respondents perceived the online teaching-learning process as moderately effective, with 18.75% rating it as highly effective and 23.75% classifying it as less effective. In parallel, five teacher-related independent variables were assessed: resource use behavior in content development, time management in delivery, student welfare orientation, meta-cognitive awareness, and perception toward online teaching. Correlation analysis revealed statistically significant positive relationships between these variables and overall effectiveness, with resource use behavior ($r = 0.486$) and meta-cognitive awareness ($r = 0.362$) emerging as particularly important. A multiple linear regression analysis demonstrated that these teacher characteristics collectively explained 48.5% of the variance ($R^2 = 0.485$) in online teaching-learning effectiveness, with meta-cognitive awareness ($p = 0.006$) emerging as the strongest predictor. To refine the model, step down regression analysis retained only two significant predictors—resource use behavior and meta-cognitive awareness—which together explained 40.8% of the variance. The findings underscore the need for capacity-building programs that enhance teachers' digital content utilization skills and foster reflective teaching practices, thereby improving the overall effectiveness and sustainability of online education in agricultural universities.

Keywords: Online teaching effectiveness, teacher competencies, resource use behavior, meta-cognitive awareness, agricultural education, step down regression

Introduction

India has the world's largest educational population of about 500 million and the higher education sector of the country is third largest in the world. In recent years, the world has witnessed a significant shift towards digital learning. This transformation has been driven by advancements in technology, changing lifestyles, and the need for accessible education. Agriculture and allied sciences education aim at quality human resource which is the main driver of comprehensive development and is the greatest treasure of our nation as it directly and indirectly serves the 42.6 percent of the total population which is dependent on agriculture and allied activities. With quality education and

research India has seen the contribution of farming towards Gross Domestic Product of 19 percent (Economic survey 2022-23) [3]. One of the reasons could be, the Fifth Deans' Committee recommendations and its implementation by agricultural and allied Universities. Where, the committee articulated the knowledge and skills needed among the graduates and recommended curricula reforms and innovations for enhancing employability, employment potential, entrepreneurship, and science-led transformation of India's food and agriculture system, enabling our graduates to become job-providers rather than job-seekers. India's national agricultural education and research system - the agricultural universities and ICAR institutes has seen the

slowdown due to COVID-19 pandemic. Under this unanticipated situations, Agriculture and Allied Universities followed the guidelines issued by Ministry of HRD and ICAR to further the Agriculture Education through online / blended teaching – learning.

New Education Policy-2020 (NEP-2020) of India proposed many changes in the education system of India, including higher agriculture education system incorporating digital learning. A national level Committee was constituted by ICAR to develop an implementation strategy to comply with various provisions of National Education Policy (NEP-2020) [4]. To implement NEP-2020, ICAR constituted the Sixth Deans' Committee to restructure the existing course curricula in agricultural education (VI Deans committee, 2024). For better implementation of the recommendations, a comprehensive understanding on how effective was the online teaching, had to be studied by universities. An extensive four semesters of online instruction delivery were implemented in Professor Jayashankar Telangana agricultural university (PJTAU) during pandemic. To understand the intricacies, a Ph.D. study on effectiveness of online teaching learning process was done.

Objective of the study

To study the effectiveness of online teaching-learning process in PJT Agricultural university.

Review of literature

Ramya (2021) [12] in her study on “Analysis of Online Teaching and Learning by the Teachers and Students” revealed that teachers' experience played a significant role in their adoption of digital resources. Less than three-fourths of the teachers had teaching experience of more than 12 years (73.34%), followed by those with 13-24 years (18.33%) and 25-36 years (8.33%). The study highlighted that experienced teachers were more adaptable to online teaching tools and content development.

Visser (2000) [16] noted that designing and planning an online course is a time-intensive process, especially for first-time instructors, as course objectives, content, activities, and assessments must be adapted for the online format. However, the study found that subsequent iterations of the course require significantly less time, as the initial groundwork has already been established.

Aydin (2005) [1] found that participants who were faculty and graduate assistants believed that the ability to manage time efficiently was very important for successful online teaching.

Varvel (2007) [14] highlighted the importance of time management skills among faculty members, emphasizing that effective instructors balance their professional responsibilities with personal commitments. The study suggests that competent faculty members ensure that lifestyle commitments do not interfere with their ability to deliver quality instruction.

Warkentin (1997) [17] explores the effectiveness of virtual work teams, noting that their performance is comparable to traditional teams. However, face-to-face team members report higher satisfaction levels, suggesting that direct interaction plays a crucial role in team dynamics and morale.

The Council of Europe (2020) [2] emphasizes the need for

educational institutions to prioritize student wellbeing. Encouraging healthy lifestyle choices can enhance students' overall wellbeing, equipping them with the knowledge to maintain long-term physical and mental health.

Ozturk (2018) [10] explored the relationship between teachers' self-reported metacognitive awareness among a sample of 30 English language teachers. The study found that only highly metacognitive instructors could effectively transfer their metacognitive understanding to lesson planning and strategy development.

Iwai (2019) [7] investigated pre-service teachers' use of literacy performance assessments to plan, implement, and analyze metacognitive strategies. The study found that pre-service teachers selected appropriate metacognitive strategies based on students' needs and lesson objectives, thereby increasing their awareness of teaching skills.

Sahoo *et al.* (2021) [13] that approximately 78%, 22%, and 0% of prospective male teachers had high, average, and low level of metacognitive awareness in teaching while, about 82%, 18%, and 0% of female prospective teachers had a high, average and low level of metacognitive awareness in teaching respectively.

Kaur and Kumar (2022) [8] examined teachers' perceptions of online teaching in Indian higher education. 78% of teachers believed online teaching fostered student independence, while 55% expressed concerns over student engagement and lack of focus during online classes. Teachers with lower digital literacy felt anxious and less confident in managing online lessons.

Rahayu and Wirza (2020) [11] reported that teachers showed a positive perception of the usefulness and ease of online learning systems during pandemic COVID-19.

Nidhi Jhawar and Tarika Nandedkar (2022) [9] found that 74% of teachers believed adaptability was crucial in the success of online teaching. However, 68% reported facing internet connectivity issues that disrupted their ability to deliver lessons effectively. Additionally, 62% expressed concerns over students' lack of engagement in virtual classrooms.

Vinayagam and Akhila (2020) [15] in a study on “Competency analysis among faculty of agriculture universities in using educational technology” found that 41.70 per cent of the respondents had medium level of expertise in the use of technology in teaching process followed by high (38.90%) and low (19.40%) level of expertise.

Research Methodology

An *Ex-post facto* research design was adopted for the study, since the variables chosen for the study have already occurred, researcher does not have direct control on influencing (independent) variables. The study was conducted in Professor Jayashankar Telangana Agricultural University in Indian State of Telangana. Teachers who have been involved in the teaching- learning process through online teaching-learning platforms during the first and second semesters of 2020-21 were considered for the study. Data was collected from a total of 80 teachers. Proportionate random sampling was followed to select the teachers who taught B.Sc. (Hons.) Agriculture, among six Agricultural colleges of the PJT Agricultural University. Six (6) agricultural colleges of Professor Jayashankar Telangana

Agricultural University, which offered courses in B.Sc. (Hons.) Agriculture, through online teaching-learning platforms during the first and second semesters of 2020-21 were considered for the study. The colleges are (1) College of Agriculture, Rajendranagar (2) Agricultural college, Aswaraopet (3) Agricultural college, Jagtial (4) Agricultural college, Palem (5) Agricultural college, Warangal, and (6) BJR Agricultural College, Sircilla. This study aimed to know, if there exists any relationship between the profile characters and the effectiveness of the online teaching learning process. The instrument designed to measure this index underwent a reliability analysis using Cronbach's alpha, which yielded a reliability coefficient of 0.81, indicating a high level of internal consistency. Well structured questionnaire (instrument) was administered to 80 respondents which included (47) Assistant professors, (14) associate professors and (19) professors, and statistical analysis was done.

Independent variables included for the study were, 1. Resource use behavior in online teaching, it refers to teacher's ability to effectively identify, develop, and integrate various digital and educational resources to enhance student learning and engagement. It involves selecting appropriate materials, adapting content for digital platforms, and ensuring accessibility and inclusivity in the online learning environment. Time management in delivery refers to a teacher's ability to effectively plan, prioritize, and allocate instructional time to optimize student learning and engagement in online courses. Student welfare orientation refers to the extent to which teachers support students' academic, emotional, and social well-being in an online learning environment. Metacognitive awareness in online teaching refers to the teacher's ability to critically reflect on their instructional practices, assess the effectiveness of their teaching strategies, and make

informed adjustments to enhance student learning outcomes. Perception on online teaching refers to teacher's attitudes, beliefs, and overall satisfaction with digital instruction, including its effectiveness, challenges, and impact on student learning outcomes. These were measured against the dependent variable effectiveness of online teaching learning process index for teachers, which was developed for the study. The effectiveness of the online teaching-learning process, is operationally defined as the degree to which teacher derived the satisfaction on the online teaching methods and strategies utilized in their courses as successful in facilitating student learning and achieving desired educational outcomes.

The data collected from the 80 respondents were subjected to appropriate statistical analyses, namely descriptive statistics like frequency, percentage, and inferential statistics including Karl Pearson coefficient of correlation(r), regression analysis, and step-down regression to identify variations, if any, in the profile characteristics of the respondents and their perceptions regarding the effectiveness of online teaching-learning. The profile characteristics were measured in low, medium and high, whereas the categorization for effectiveness of teaching-learning process, based on index was done as less effective, effective and highly effective.

Results and Discussion

Effectiveness of online teaching learning process indicators included Teaching Competencies, Online learning readiness of students, additional resources provided to students, Curriculum during online teaching, Study skills & online learning engagement of students, Work environment distractions, Perceived satisfaction of teachers. The results are as follows:

Table 1: Effectiveness of online teaching-learning process indicators (n=80)

| S. No. | Online teaching-learning Indicators | Category | Frequency | Percentage |
|--------|---|--------------------|-----------|------------|
| 1 | Online Teaching Competencies | Poor competencies | 13 | 16.25 |
| | | Fair competencies | 54 | 67.5 |
| | | Good competencies | 13 | 16.25 |
| 2 | Online learning readiness of students | Poor readiness | 24 | 30.00 |
| | | Fair readiness | 33 | 41.25 |
| | | Good readiness | 23 | 28.75 |
| 3 | Academic Resources | Poor accessibility | 09 | 11.25 |
| | | Fair accessibility | 59 | 73.75 |
| | | Good accessibility | 12 | 15.00 |
| 4 | Curriculum adaptability during online teaching | Poor adaptability | 09 | 11.25 |
| | | Fair adaptability | 50 | 62.50 |
| | | Good adaptability | 20 | 25.00 |
| 5 | Study skills & online learning engagement of students | Poor | 14 | 17.50 |
| | | Fair | 54 | 67.50 |
| | | Good | 12 | 15.00 |
| 6 | Work environment distractions | Low | 12 | 15.00 |
| | | Moderate | 59 | 73.75 |
| | | High | 09 | 11.25 |
| 7 | Perceived satisfaction of teachers | Low | 15 | 18.75 |
| | | Medium | 47 | 58.75 |
| | | High | 18 | 22.50 |

The categories, Poor: reflecting low levels of competency, readiness, accessibility, or satisfaction. Fair: reflecting moderate or acceptable levels of each dimension. Good:

reflecting high levels of competency, readiness, accessibility, or satisfaction. Frequency: The number of respondents falling into each category. Percentage: The

proportion of respondents in each category, helping identify which aspects of online teaching-learning are most and least successful. The key observations from the table 1, Online Teaching Competencies: The majority of teachers (67.5%) were found to have fair competencies, while 16.25% exhibited good competencies. This suggests that while many teachers have adapted to online teaching, there is still room for improvement in enhancing their digital pedagogical skills. 2. Online Learning Readiness of Students: 41.25% of students displayed fair readiness, with only 28.75% exhibiting good readiness. This highlights gaps in students' preparedness, possibly due to varying technological literacy and self-regulation skills. 3. Academic resources: 73.75% of teachers shared sufficient academic resources. 4. Curriculum adaptability: 62.5% of respondents felt the curriculum was fairly adaptable, while 25% rated it as good. This indicates that some curricular adaptation have been done to suit digital teaching. 5. Study Skills and Engagement: 67.5% respondents felt, students demonstrated fair study skills and engagement, suggesting that a significant proportion of students are managing their learning with moderate effectiveness, while some struggle with self-directed learning in the online environment. 6. Work environment distractions: 73.75 per cent reported

moderate distractions in their teaching environments, while 15% experienced low distractions. 7. Perceived satisfaction of online teaching: 58.75% of teachers expressed medium levels of satisfaction, while 22.5% reported high satisfaction levels. This mixed satisfaction likely reflects a combination of technological, administrative, and student-related challenges faced by teachers during online teaching. Overall, The Online Teaching-Learning Indicators Table,1 offers a holistic snapshot of how teachers experienced online education across key indicators. While many respondents fall into the "fair" category for most indicators, there are pockets of both excellence and serious challenges. These findings highlight: The need for targeted training programs to enhance teachers' competencies. The importance of addressing digital inequalities, ensuring students have adequate access to devices and connectivity. The need for enhancing student engagement strategies, especially to foster self-regulated learning skills. The value of curriculum adaptation that better fits the online learning context. The necessity for creating supportive digital institutional environments to minimize distractions and improve satisfaction. The data received from respondents was normalized for the calculation of index scores and categories were given indicator wise below. In Table 2:

Table 2: Effectiveness of indicators scores (n=80)

| Category | Online Teaching Competencies | Online learning readiness of students | Academic resources | Curriculum adaptability in online teaching | Study skills & online learning engagement of students | Work environment distractions | Perceived satisfaction of teachers |
|----------------------------------|------------------------------|---------------------------------------|--------------------|--|---|-------------------------------|------------------------------------|
| Less effective (0.00-0.34) | 5 (06.25%) | 30 (37.50%) | 47 (58.75%) | 45 (56.25%) | 28 (35.00%) | 33 (41.25%) | 17 (21.25%) |
| Moderately effective (0.34-0.67) | 46 (57.50%) | 27 (33.75%) | 21 (26.25) | 15 (18.75%) | 45 (56.25%) | 38 (47.50%) | 42 (53.50%) |
| Highly effective (0.67-1.00) | 29 (36.25%) | 23 (28.75%) | 12 (15.00%) | 20 (25.00%) | 7 (08.75%) | 9 (11.25%) | 21 (26.25%) |

Key Observations of table 2 are, 1. Online Teaching Competencies, the majority of teachers (57.5%) fall into the moderately effective category, indicating a reasonable but not optimal level of preparedness and digital teaching proficiency. Encouragingly, over 36% of teachers are highly effective, demonstrating that some teachers have successfully adapted to online teaching. 2. Online Learning Readiness of Students, student readiness poses a considerable challenge, with over 37% classified as less effective in their readiness for online learning. This highlights gaps in students' technical, cognitive, and motivational preparedness, which may stem from limited prior exposure to online learning environments. 3. Additional Academic resources, with nearly 59% of teachers categorized as less in this area. It indicates that the course materials provided by the university was sufficient and very less additional resources were actually required and shared. This shows the subject specialization requirements were met through the existing resources. 4. Curriculum adaptability, approximately, 56% of respondents found the curriculum adaptation to online formats to be less effective. This suggests that existing curricular structures may not fully support online pedagogy,

with potential gaps in flexibility, interactivity, and contextual relevance. 5. Study Skills and Engagement, over 35% teachers felt, students demonstrated less effective study skills and engagement, pointing to difficulties in self-regulation, time management, and active learning participation in online settings. This is a crucial area for intervention, as effective study habits directly influence learning outcomes in remote environments. 6. Work Environment Distractions, work environment distractions are prevalent, with 41.25% of respondents classified as less effective in this regard. 7. Perceived Satisfaction of Teachers, Teachers' satisfaction with online teaching is moderate overall, with 53.5% falling into the moderately effective category. However, it is noteworthy that over 26% reported high satisfaction, indicating that a subset of teachers has positively embraced online teaching, while 21% remain less satisfied, likely due to technological challenges, student disengagement, hands on experience must be crucial in the subjects they taught, or institutional constraints. Further, summation of the scores obtained was done to find out the total effectiveness index value. It is found to be moderate to low effective, in the below, table 3.

Table 3: Teachers Effectiveness index (n=80)

| Effectiveness Index | Category | Class interval | score | Percentage |
|---|----------------------|----------------|-------|------------|
| Overall Effectiveness of Online teaching learning process | Less effective | 0.00-0.34 | 19 | 23.75 |
| | Moderately effective | 0.34-0.67 | 43 | 53.75 |
| | Highly effective | 0.67-1.00 | 15 | 18.75 |

Total Effectiveness Results (table 3): Moderately Effective Dominance is seen; the majority of respondents (53.75%) fell into the moderately effective category. This indicates that while online teaching-learning processes have achieved a reasonable level of effectiveness, there are significant opportunities for improvement, particularly in areas such as student readiness, engagement, and resource accessibility. Less Effective Group: nearly one-fourth of the respondents (23.75%) experienced online teaching-learning as less effective, suggesting that for a substantial segment of the population, current online education practices are failing to provide adequate learning experiences. This could stem from technological barriers, lack of preparedness, or ineffective pedagogical strategies. Highly Effective category, encouragingly, 18.75% of respondents rated their online teaching-learning experiences as highly effective. This subgroup demonstrates that under optimal conditions, effective online teaching-learning is achievable. Key contributing factors for this group likely include high teacher competence, strong student engagement, reliable academic resources, and conducive teaching environments.

Table 4: Independent Variables and their distribution (n=80)

| S. No. | Independent variables | Category | Frequency | Percentage |
|--------|---|----------|-----------|------------|
| 1. | Resource use behavior in content development for online teaching – learning | Poor | 18 | 22.50 |
| | | Fair | 25 | 31.25 |
| | | Good | 31 | 46.25 |
| 2. | Time management in delivery | Poor | 17 | 21.25 |
| | | Fair | 29 | 36.25 |
| | | Good | 34 | 42.50 |
| 3. | Student welfare orientation | Poor | 19 | 23.75 |
| | | Fair | 42 | 52.50 |
| | | Good | 19 | 23.75 |
| 4. | Meta-cognitive awareness | Poor | 34 | 42.5 |
| | | Fair | 18 | 22.5 |
| | | Good | 28 | 35.0 |
| 5. | Perception on online teaching | Poor | 27 | 33.75 |
| | | Fair | 32 | 40.00 |
| | | Good | 21 | 26.25 |

Table 4 shows, 1. Resource use behavior in Content Development, nearly 46.25 per cent of teachers exhibited good resource use behavior, indicating a considerable proportion of teachers are adept at identifying and using online resources effectively. However, 22.50 per cent of teachers remain in the poor category, pointing to gaps in digital content curation skills that may limit their ability to deliver high-quality online instruction. 2. Time Management in Delivery 42.50% of teachers demonstrated good time management skills, suggesting that many teachers have developed effective strategies to structure online classes, allocate time for interaction, and manage assignments

efficiently. However, over one-fifth (21.25%) continue to struggle with effective time management, which may affect content coverage and student engagement. 3. Student Welfare Oriented Teachers concern for students welfare was distributed across categories, with 52.5 per cent demonstrating fair student welfare orientation. This reflects a moderate level of attention to students’ emotional and academic needs, though some teachers (23.75%) showed low welfare orientation, indicating the need for increased emphasis on student-centered online teaching approaches. 4. Meta-Cognitive Awareness, was lower compared to other competencies, with 42.5 per cent of teachers falling in the poor category. This suggests that many teachers felt, there is no need to over simplify the subject, given the entry qualifications of the undergraduate students. 5. Perception on Online Teaching, were relatively mixed, with only 26.25 per cent holding a positive view (good category). Nearly 34 per cent held poor perceptions, indicating that a significant proportion of teachers may remain skeptical of the effectiveness, feasibility, and pedagogical value of online teaching, likely due to technological constraints, student disengagement, or personal discomfort with digital platforms.

Association between effectiveness of online teaching learning process and independent variables of teachers:

The correlation analysis was performed to assess the strength and direction of the relationships between each independent variable (teacher-related factors) and the dependent variable (effectiveness of online teaching-learning processes) and identify which teacher characteristics are most closely associated with effective online teaching-learning. Serve as a preliminary step before regression analysis, helping to screen for variables that warrant further exploration as predictors of effectiveness.

Table 5: Correlation coefficients between independent variables and dependent variable: (n=80)

| S. No. | Independent Variables | Correlation coefficient (r) |
|--------|--|-----------------------------|
| 1. | Resource use behavior in content development | 0.486 ** |
| 2. | Time management in delivery | 0.390 ** |
| 3. | Student welfare | 0.380 ** |
| 4. | Meta-cognitive awareness | 0.362 ** |
| 5. | Perception on online teaching | 0.290 ** |

** Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

The table 5, presents Pearson correlation coefficients (r values) for the relationship between each independent variable and the overall effectiveness of online teaching-learning processes. The value of r ranges from -1 to +1, where = +1 indicates a perfect positive relationship — as the independent variable increases, effectiveness also increases. r = 0 indicates no linear relationship. r = -1 indicates a perfect negative relationship — as the independent variable increases, effectiveness decreases. Statistical Significance, all correlations are statistically significant at the 0.01 level. This indicates that there is less than a 1% probability that these relationships occurred by chance. Therefore, we can state that these teacher characteristics are genuinely associated with online teaching-learning effectiveness in the

sample. The strongest correlation was observed between resource use behavior in content development ($r = 0.486$) and effectiveness, indicating that teachers who effectively sourced, adapted, and utilized digital content were more likely to achieve better online teaching outcomes. Similarly, meta-cognitive awareness ($r = 0.362$) and time management ($r = 0.390$) also showed moderate positive correlations with effectiveness, reinforcing the importance of self-regulatory skills and structured time management in online teaching success.

Regression analysis for independent variables and dependent variable: The regression analysis was conducted to assess how well the set of independent variables (teacher characteristics) jointly predict the effectiveness of the online teaching-learning process. Quantify the individual contribution of each independent variable to online teaching-learning effectiveness and develop a statistical model that explains variations in effectiveness based on the combined influence of these teacher characteristics.

Table 6: Regression analysis of independent variables and dependent variable: (n=80)

| S. No. | Independent variables | Standard error (Seb) | 't' value | significance |
|----------------------------|--|----------------------|-------------------|----------------------------|
| 1. | Resource use behavior in content development | .159 | .768 | .445 |
| 2. | Time management in delivery | .224 | 1.254 | .214 |
| 3. | Student welfare | .145 | .864 | .391 |
| 4. | Meta-cognitive awareness | .269 | 2.819 | .006** |
| 5. | Perception on online teaching | .221 | 1.989 | .051* |
| Model Summary ^b | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .696 ^a | .485 | .401 | .17634 |

** $p < 0.01$ (Highly significant)

* $p < 0.05$ (Marginally significant)

In table 6, Dependent Variable, overall Effectiveness of Online Teaching-Learning Processes and independent Variables, 1. Resource Use Behavior in Content Development, 2. Time Management in Delivery 3. Student Welfare Orientation 4. Meta-Cognitive Awareness 5. Perception on Online Teaching These five independent variables reflect key teacher competencies, behaviors, and attitudes, all of which were hypothesized to influence the effectiveness of online teaching-learning. Interpretation of Model Summary, shows, R (0.696) indicates a moderate to strong overall relationship between the combined independent variables and the effectiveness of online teaching-learning. R Square (0.485) shows that 48.5% of the variance in effectiveness can be explained by the combined influence of the five teacher characteristics. Adjusted R Square (0.401), which corrects for the number of predictors,

confirms that the model retains a strong explanatory power, explaining about 40.1% of the variance after accounting for model complexity.

Step down regression analysis: Step Down Regression Analysis is a systematic variable reduction technique used to develop a parsimonious (simplified) regression model. It identifies the most essential predictors of a dependent variable by removing variables that do not significantly contribute to the model's explanatory power. The goal is to create a final model that retains only the strongest predictors, balancing model simplicity with explanatory effectiveness. This approach is particularly valuable in social science research, where many factors may influence an outcome, but only a subset provides meaningful predictive power.

Table 7: Step down regression analysis (n=80)

| Model | Predictors | Standard error (SEb) | 't' value | significance |
|-------|--|----------------------|-----------|--------------|
| 1. | (Constant) | .141 | -2.452 | .016 |
| | Resource use behavior in content development | .005 | 4.912 | .000 |
| 2. | (Constant) | .131 | -2.615 | .011 |
| | Resource use behavior in content development | .004 | 5.580 | .000** |
| | Meta-cognitive awareness | .003 | 3.166 | .002** |

Table 7.1: Model summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .486 ^a | .236 | .226 | .20047 |
| 2. | .639 ^b | .408 | .384 | .17883 |

a. Predictors: (Constant), Resource use behavior in content development

b. Predictors: (Constant), Resource use behavior in content development, Meta-cognitive awareness.

** $p < 0.01$ (Highly significant) * $p < 0.05$ (Marginally significant)

Table 7 shows that, Resource Use behavior in content development was the strongest predictor, with a highly significant p-value of 0.000. Meta-Cognitive Awareness

was also significant, with a p-value of 0.002. All other variables (Time Management, Student Welfare, Perception on Online Teaching) were removed during the step-down process because they did not make significant independent contributions when the two retained predictors were already included. The final model summary, table 7.1, containing only Resource Use Behavior and Meta-Cognitive Awareness, explained 40.8% of the variance in online teaching-learning effectiveness. The R value (0.639) indicates a moderately strong relationship between the two retained predictors and the dependent variable. The Adjusted R Square (0.384) confirms that the model's explanatory power is preserved even after accounting for

model complexity.

These findings suggest that teachers' ability to effectively utilize digital resources and their capacity for self-reflective teaching practices form the core foundation for successful online education. This simplified two-variable model provides a clear roadmap for capacity-building initiatives, allowing institutions to focus training efforts on developing digital proficiency and reflective teaching skills. By concentrating on these key competencies, educational institutions can improve online teaching effectiveness more efficiently than through broader, unfocused professional development programs.

Conclusion

- 1. Overall Effectiveness is Moderate:** The majority of teachers experienced online teaching-learning process as moderately effective, indicating room for improvement in several key dimensions such as student engagement, curriculum adaptability, and access to digital resources.
- 2. Teacher Characteristics Significantly Influence Effectiveness:** The study confirms that teachers' abilities to effectively use digital resources, manage their teaching time, maintain student welfare, engage in reflective teaching practices, and maintain positive perceptions toward online teaching all contribute positively to teaching-learning effectiveness.
- 3. Resource Use Behavior and Meta-cognitive Awareness are the Strongest Predictors:** Among the examined teacher characteristics, resource use behavior and meta-cognitive awareness stand out as the two most important predictors of online teaching-learning effectiveness. This suggests that technical proficiency in sourcing and using digital content, combined with the ability to reflect on and adjust teaching approaches, is critical for ensuring effective online education.
- 4. Professional Development Implications:** These findings underscore the importance of continuous professional development programs that focus on: Training teachers to curate, adapt, and effectively deliver digital content. Enhancing teachers' meta-cognitive skills, helping them become more reflective and adaptive in their teaching approaches. Supporting teachers in time management and student engagement strategies, as these skills, though not the strongest predictors, still contribute meaningfully to online teaching success.
- 5. The Need for Infrastructure and Student Support:** While teacher-related factors are critical, the data also highlighted gaps in student readiness, access to digital resources, and environmental distractions, which collectively limit overall effectiveness. Therefore, a holistic approach that improves both teacher capacity and student support systems will be necessary to enhance the overall quality of online teaching-learning experiences.

Final Note

The findings of this study provide a data-driven basis for educational institutions, policymakers, and teacher training programs to prioritize key teacher competencies and structural supports to strengthen the effectiveness and

sustainability of online teaching-learning processes in the future.

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