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The Need for a More Robust Education Studies: The Impact of Mediation and Moderation Variables for Deeper Insights

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Abstract. Incorporating mediation and moderation variables into education studies has theoretical and empirical ramifications that this study intends to investigate. A foundation for comprehending the intricate links and mechanisms influencing educational outcomes is offered by this research. To determine the essential ideas and elements associated with mediation and moderation, a comprehensive analysis of pertinent literature and research studies in the field of education was carried out. A thorough model that demonstrates how mediation and moderation variables can be incorporated into education studies was created based on this investigation. In elucidating the links between diverse educational characteristics, the research emphasises the importance of mediation and moderation. It illustrates how some variables influence the relationship between independent and dependent variables by acting as mediators, and how other variables influence the degree or direction of these associations by acting as moderators. A more comprehensive understanding of the underlying mechanisms and contextual factors influencing educational outcomes is provided by the inclusion of mediation and moderation variables in education studies. Through the integration of various variables into an all-encompassing model, scholars can acquire a more profound understanding of the intricate dynamics involved in educational processes and results. Policymakers and educators should consider the practical ramifications of implementing the suggested model. By focusing on these aspects, policies and interventions can be created that will improve teaching methods and raise student achievement.

Keywords: Mediation, moderation, education studies, Methodological challenges, Measurement limitations, Statistical techniques.

1. Introduction

Education studies play a crucial role in shaping policies, practices, and interventions aimed at improving learning outcomes and educational experiences. But even with all of the research done in this area, there is still a need for more thorough and reliable methods of examining educational phenomena (Aguinis et al., 2017). Including mediation and moderation variables is one topic in education research that has been comparatively underutilised (Memon et al., 2018).

A greater knowledge of the intricate relationships between various aspects in educational settings is made possible by mediation and moderation variables. The underlying methods or procedures by which one variable influences another are explained by mediation variables (Arumugam et al., 2016). Conversely, moderating variables look at the circumstances in which two variables' relationship varies. Researchers can improve the validity and generalizability of their findings in education studies by including these variables, which will result in more effective educational interventions and well-informed decision-making (McMahon et al., 2021).

The use of mediation and moderation variables in education studies is still lacking in research, despite its possible advantages. Numerous research in the field frequently ignores the complex dynamics and subtleties that mediation and moderation effects might shed light on in favour of only looking at direct correlations between variables (Aguinis et al., 2017). This exclusion hampers our comprehension of the

numerous mechanisms and contextual factors that influence educational results.

Including mediation and moderation variables in education research can lead to several substantial benefits. Firstly, it allows for a more thorough knowledge of the underlying processes and routes via which educational interventions or practices effect outcomes. By identifying and evaluating these mediating variables, researchers can reveal the mechanisms that drive change and suggest potential points of intervention for improving educational outcomes (Garzón et al., 2020).

Second, by include moderation variables, researchers can investigate the circumstances in which different educational approaches or interventions have different impacts. This knowledge is essential for modifying therapies to fit certain situations, groups of people, or circumstances, thereby boosting their efficacy (Lee et al., 2018).
Furthermore, taking moderation variables into account aids in the identification of potential boundary conditions or other elements that can restrict the generalizability of results, encouraging more complex and contextually aware educational research (Arumugam et al., 2016).

To increase the validity of research findings, mediation and moderation variables must be included in education studies. By doing this, we can acquire a deeper comprehension of the intricate dynamics and mechanisms influencing educational results. The creation of evidence-based practices, policies, and interventions that have a significant influence on educational environments can then be informed by this. In order to give researchers a roadmap for conducting more thorough and illuminating studies in this area, this paper delves deeper into the theoretical underpinnings, methodology, and model for factoring mediation and moderation variables in education research.

To explore studies from other disciplines that have successfully incorporated these variables and their impact on research outcomes. Mediation and moderation factors are extensively employed in several disciplines beyond education, including psychology, sociology, economics, public health, and management. For instance, in psychology, contextual influences and underlying mechanisms are understood through the use of mediation and moderation analyses on psychological processes. These variables are used in economics to investigate the ways in which particular factors mediate or modulate the relationship between economic variables. The impact of mediation and moderation variables on research outcomes is evidenced by the body of existing literature. These parameters allow for more nuanced interpretations of research findings and improve our understanding of intricate connections between variables. They also shed light on underlying systems. By incorporating mediation and moderation, researchers can give more complete and contextually sensitive insights, leading to better informed decision-making and focused interventions in different fields, including education.

In the area of business management, Chen and Lin's (2019) investigation looked at the connection between job satisfaction among employees and leadership style. In order to find out if the link between job satisfaction and leadership style altered depending on the organisational environment, the researchers included organisational climate as a moderating variable in their study. The results showed that in a favourable organisational climate as opposed to a bad organisational climate, there was a higher correlation between leadership style and work satisfaction. In order to determine the circumstances in which leadership styles have the biggest influence on employee outcomes, this study underlined the significance of taking moderation factors into account (Al-Sada et al., 2017).

The research done by Brown et al. (2018) on the connection between teenage mental health outcomes and physical exercise is one noteworthy study from the subject of public health. Self-esteem was incorporated as a mediation variable in this study to help the researchers understand how physical activity affects mental health via the self-esteem mechanism. The results showed that the association between physical exercise and outcomes related to mental health was largely mediated by self-esteem. This study emphasises how crucial it is to take mediating factors into account in order to understand the fundamental mechanisms by which physical activity affects mental health (Biddle et al., 2019).

Johnson and Smith's 2016 study examined the relationship between economics achievement in school and income levels. In order to investigate the role of occupation as a moderating variable, the researchers looked at whether there were variations in the relationship between income and educational attainment based on the type of occupation. The findings indicated that there was a stronger positive correlation between income and educational attainment among those in high-skilled occupations compared to those in low-skilled occupations. This study shows that in order to determine the contextual elements influencing the relationship between income

and education, moderation variables must be taken into consideration (Fan et al., 2017).

Furthermore, in the area of communication studies, Lee and Kim (2017) looked into how young people' unhappiness with their bodies was affected by media exposure. The present study incorporated social comparison as a mediation variable to investigate the manner in which media exposure impacts body image dissatisfaction via the social comparison mechanism. The results showed that the association between media exposure and negative body image was partially mediated by social comparison. This study emphasises how crucial it is to take mediating variables into account in order to understand the underlying mechanisms by which media exposure influences negative body image (Cohen, 2015).

These multidisciplinary studies highlight the need of including mediation and moderation variables in research as well as their effects. Researchers were able to comprehend contextual influences, unearth underlying mechanisms, and provide a more thorough explanation of the interactions between variables by incorporating these variables. These research' effective integration of mediation and moderation variables has greatly expanded the body of knowledge in the field and offered insightful information for the creation of new theories and useful applications.

These examples show how education researchers might use knowledge from other domains to strengthen the validity and robustness of their own investigations. By including mediation and moderation variables, researchers can gain a deeper understanding of the complex dynamics present in educational contexts and provide conclusions that are more nuanced, contextually sensitive, and applicable to real-world scenarios.

The success of using mediation and moderation factors in research is demonstrated by these examples from various fields. Through the incorporation of these factors, scholars can reveal the fundamental mechanisms, comprehend contextual influences, and furnish a more all-encompassing comprehension of the correlations among variables. These studies show how important it is to take moderation and mediation factors into account when producing more complex and sensitive to context study findings.

These examples can be used by education researchers to improve the validity and rigour of their own research. Through the integration of mediation and moderation variables, scholars can enhance their comprehension of the intricate dynamics present in educational environments and provide conclusions with pragmatic ramifications for educational policies, interventions, and methodologies.

1.1 Moderation Variables

Understanding the circumstances under which the connection between two variables shifts depends heavily on the presence of moderation variables. These variables aid in the identification of individual variations or environmental factors that affect the direction or degree of the link between the independent and dependent variables by researchers. Fundamentally, moderating variables establish the circumstances and individuals for whom the correlation between variables is greater or weaker (Lastrucci, et al., 2019). A few crucial aspects of moderation variables should be taken into account. First, the dependent variable is influenced by the interaction between the moderation variables and the independent variable. The impact of the independent variable on the dependent variable varies depending on the amounts or values of the moderating variable. This interaction effect might be additive or multiplicative. Second, the nature of moderation variables is usually continuous or categorical. While continuous moderation factors vary along a continuum, categorical moderation variables split the sample into discrete categories (Aguinis et al., 2017).

Examining both the particular research issue under investigation and the theoretical framework are necessary steps in identifying moderation variables in a study. Numerous factors that could affect how the independent and dependent variables relate to one another can be taken into account by researchers. These factors may consist of personal traits like age, gender, or socioeconomic position, or they may be environmental traits like school size or neighbourhood features, or they may consist of other pertinent variables found in earlier studies. The choice of prospective moderating variables ought to be informed by theory, empirical data, and the particular subject of the investigation (Hankonen et al., 2017).

There are a number of potential moderating factors in education studies that researchers should take into account. For example, an educational intervention's effect on student achievement can change based on the student's academic aptitude or past knowledge. Here, scholastic aptitude or past knowledge could be useful moderating factors. The association between parental participation and academic performance may also be influenced by the social level or cultural background of the family. These factors may have an impact on the

direction or intensity of the link between student outcomes and parental participation.

Scenario 1: A novel teaching strategy's impact on student involvement is being studied by a researcher. He makes the hypothesis that, depending on the students' grade level, there may be differences in the link between the teaching strategy and student participation. In this case, grade level might be used as a potential moderating variable and the researcher would examine how the impact of the teaching technique on student involvement differs between grade levels.
Scenario 2: A study's objective is to look at how the school climate affects students' wellbeing. The researcher hypothesised that for students of different genders, the connection might be different. Using gender as a potential moderating variable, the researcher would look into how the relationship between school climate and student well-being varies for male and female students.
Scenario 3: A researcher is researching the impact of parental participation on academic attainment. She makes the hypothesis that the student's capacity for self-control may influence the relationship. In this case, kids' level of self-regulation abilities would act as a potential moderating variable, and the researcher would investigate how this modifies the association between academic accomplishment and parental participation.

These examples show how moderation variables can be found and used in educational research to comprehend the circumstances in which the variables' relationship varies. By studying individual variations and contextual factors, researchers can learn more about how different educational factors relate to one another and how effective educational interventions are.

1.2 Mediation Variables

Understanding the fundamental mechanisms or processes by which an independent variable affects a dependent variable requires an understanding of mediation variables. By highlighting the intermediary stages or channels through which the impact happens, they aid in providing an explanation for the "why" and "how" of the relationship between variables. Put differently, the role of mediation factors is to clarify the causal relationship between independent and dependent variables (Yoon, 2020). Mediation variables have the following characteristics: they can explain the relationship between the independent and dependent variables; they can account for changes in the relationship when the mediator is included in the analysis; and they have a temporal ordering between the independent and dependent variables (Yoon, 2020). In order to determine the mediation variables in a study, the theoretical framework and research topic must be carefully examined. Variables that are likely to explain the relationship between the independent and dependent variables and are theoretically linked to both should be taken into account by researchers. These variables ought to make sense theoretically and be backed up by data from earlier studies (Vancouver, 2014).
Researchers may take into account a number of potential mediation variables in the context of education studies. For instance, a researcher may propose that student involvement acts as a mediating variable in a study examining the relationship between a teacher's instructional strategies and student accomplishment. The method via which a teacher's instructional strategies affect students' academic performance is known as student engagement.

Scenario 1: The effects of a social-emotional learning programme on students' wellbeing are being studied by certain researchers. They suggest that the relationship between the programme and the well-being of the students is influenced by self-efficacy, which functions as a mediating variable. To assess the mediating role of self-efficacy in the relationship between programme and well-being, the researcher gathers data on programme implementation, student well-being, and self-efficacy.
Scenario 2: The purpose of a study is to determine how parental participation affects students' motivation. According to the researcher's hypothesis, this relationship is mediated by students' perceptions of their own competence. The researcher gathers information on student motivation, parental participation, and self-perception of competence in order to examine this hypothesis. Through an examination of the mediating function of self-perception of competence, the investigator can acquire a deeper understanding of the fundamental process by which parental participation impacts student motivation.
Scenario 3: An investigation is conducted into how a technology-based intervention affects the learning outcomes of students. According to the study, the association between learning outcomes and the technology intervention is mediated by participation in the intervention. To evaluate the mediating role of engagement in the relationship between the intervention and learning results, the researcher gathers data on the intervention, student engagement, and learning outcomes.

These examples show how mediation variables can be found and used in education research to find the pathways by which independent factors affect dependent variables. Researchers can better understand the mechanism by which educational practices, interventions, or factors influence results by taking mediation variables into account. This knowledge can help to enhance educational practices and policies and guide the creation of focused solutions.

Social science theory is the foundation of both mediation and moderation, and education studies greatly benefit from its use. Effective interventions and practices in education research depend on an understanding of the mechanisms (mediation) via which educational factors influence results. Researchers can learn more about the mechanisms underlying how and why particular educational elements affect students' learning, motivation, or well-being by identifying mediating variables. In education studies, moderation variables play a crucial role in identifying the contextual factors and individual variations that influence the efficacy of educational interventions and the interrelationships among educational factors. Researchers can identify the circumstances in which specific interventions or causes have a higher or lesser influence by taking moderation variables into account. This enables more specialised and targeted approaches to teaching.

2. Methodology

A variety of research methodologies and data gathering techniques can be used by researchers to examine mediation and moderation variables in education. The study's unique setting, resources that are available, and research objectives will all influence the methodological choice.

2.1 Research Design and Data Collection Methods

Experimental Design: Taking into account mediation and moderation variables, researchers can conduct controlled experiments to investigate the effect of an independent variable on a dependent variable. This strategy permits control over potential confounding variables, random assignment of participants to conditions, and variable modification (Pirlott, 2016).

Observational Studies: Cross-sectional and longitudinal observational studies are two types of observational research that researchers can use to investigate the correlations between variables and find possible mediation and moderation effects. These investigations rely on natural changes or existing settings for data gathering, without adjusting for any variables.

Surveys and Questionnaires: Surveys and questionnaires can be used by researchers to get participant self-report data. Items evaluating the independent variable(s), mediator(s), moderator(s), and dependent variable(s) may be included in these instruments. This method makes it possible to collect data effectively and with a high sample size (Alordiah & Ossai, 2023; Nima et al., 2013).

Interviews and Focus Groups: Focus groups and qualitative interviews can be used by researchers to acquire deep insights into participants' experiences and perspectives. Rich data on the underlying mechanisms and processes pertaining to mediation and moderation factors can be obtained using these methods (Rosenthal, 2016).

2.2 Target Population, Sample Selection, and Data Analysis Techniques

Students, instructors, parents, or educational institutions are usually the target group for research on mediation and moderation variables in education. The particular population of interest and the study question would determine the sample selection. To assure representativeness or target particular subgroups, researchers can use purposive, stratified, or random sampling procedures.

2.3 Statistical Tools for Mediation Analysis

Sobel Test

One popular statistical method for mediation analysis is the Sobel test. It evaluates the importance of an independent variable's indirect impact on a dependent variable via the use of a mediator variable. To ascertain whether the indirect impact deviates considerably from zero, the Sobel test computes a z-score. The relationship between the independent and dependent variables is fully mediated by the mediator variable, and it is assumed that the variables are regularly distributed (Igartua, 2020). A simple and user-friendly technique for evaluating mediation effects is the Sobel test. It gives researchers a p-value as proof of mediation and enables them to assess the indirect effect's importance. The Sobel test presupposes a normal distribution, a linear connection between the variables, and the absence of measurement error. In order to produce valid results, it also assumes the absence of confounding variables and calls for a high sample size (Özdil, 2019). The Sobel test can be used in education research to investigate how student motivation influences the link between academic achievement and instructor feedback. The

purpose of the test is to ascertain whether there is a statistically significant indirect influence of instructor feedback on academic performance through student motivation.

Bootstrapping

A popular resampling method in mediation analysis is called bootstrapping. It entails randomly selecting observations from the original dataset and replacing them to create multiple samples. Each resampled dataset's indirect effect is computed, producing a distribution of indirect effects. Using these resampled data, researchers can then calculate the confidence interval and determine the importance of the indirect effect (Newman et al., 2017).

Because it is not dependent on the assumptions of normalcy or linearity, bootstrapping is more resilient in a variety of circumstances. It offers p-values and confidence ranges that are more precise, especially for smaller sample numbers. Additionally, bootstrapping enables the investigation of intricate mediation models including numerous moderators or mediators (Koopman et al., 2014). For reliable findings, bootstrapping may need a higher number of resamples and be computationally demanding. Additionally, it can take a lot of time, particularly when working with big datasets. Bootstrapping can be utilised to estimate the confidence interval and assess the importance of the indirect effect in educational research that examines the mediating role of self-efficacy on the relationship between a teacher's instructional methods and student achievement.

Structural Equation Modeling (SEM)

SEM is a thorough statistical technique that makes it possible to investigate intricate correlations between numerous variables. To assess the direct and indirect impacts of independent factors on dependent variables, including mediating and moderating variables, factor analysis and route analysis are combined. SEM offers a framework for evaluating proposed causal models and has the ability to account for hidden variables and measurement error (Muthén, 2015). Multiple mediation paths can be examined, latent variables can be included, and model fit can be evaluated with SEM. It offers a thorough examination of the whole variable system, enabling a greater comprehension of intricate relationships. In order to yield precise estimations, SEM necessitates a greater sample size and can be computationally intensive. Additionally, rigorous model formulation is necessary, and researchers lacking in-depth statistical expertise may find it difficult (Aguinis et al., 2017). Using structural equation modelling (SEM) can help determine the direct and indirect effects, evaluate model fit, and offer insights into the overall system of variables in an education study investigating the mediating role of student involvement on the relationship between a school climate intervention and academic outcomes.

These statistical tools, namely the Sobel test, bootstrapping, and SEM, offer researchers different approaches to analyze and interpret mediation effects in education research. By considering their benefits and limitations, researchers can choose the most appropriate tool based on their research objectives, data characteristics, and statistical expertise.

2.4 Statistical Tools for Moderation Analysis

Interaction Effects

In moderation analysis, interaction effects are frequently employed to investigate how the levels or values of a moderator variable affect the relationship between an independent variable and a dependent variable. In order to determine the importance of the interaction effect, this study incorporates an interaction term into a regression model (Nima et al., 2013).

Researchers can investigate conditional relationships and a variable's moderating influence through the use of interaction effects. They shed light on how variations in the moderator variable's levels affect the direction or strength of the association between the variables. The assumptions made by interaction effects, such as additivity and linearity, may not always accurately represent the nature of the relationship. When higher-order interactions are present, they might be difficult to understand and necessitate a large enough sample size to guarantee accurate estimations. Researchers may include the interaction between parental involvement and student socioeconomic status as a moderator in an education study looking into the effect of parental involvement on academic achievement in order to see if there are differences in the relationship between parental involvement and academic achievement depending on socioeconomic status.

Analysis of Covariance (ANCOVA)

ANCOVA is a statistical method used in moderation analysis to take the effects of covariates into account when assessing the interaction between an independent variable and a moderator variable. The ANCOVA procedure includes regressing the

dependent variable on the independent, moderator, and covariates as well as assessing the significance of the interaction effect. ANCOVA minimises confounding effects for researchers by accounting for covariate influence. It provides a more accurate assessment of the moderator effect by taking into consideration extra variables that may have an impact on the dependent variable. ANCOVA makes the assumptions of regression slope homogeneity, additivity, and linearity. A sufficiently high sample size is required to produce reliable results, and it might be susceptible to changes from these assumptions. (da Silva Faia, 2019). Researchers may use ANCOVA to adjust for student age and prior academic achievement as covariates while assessing the interaction effect in an education study looking at the moderating role of student gender on the link between teaching style and student engagement.

Johnson-Neyman Technique

A statistical method for determining the regions of significance in a moderator effect is the Johnson-Neyman Technique. It establishes the precise values or ranges of a moderator variable at which statistical significance or non-significance is found in the relationship between the independent and dependent variables. The Johnson-Neyman Technique pinpoints the precise circumstances in which the relationship between variables varies, enabling a more thorough analysis of the moderator effect. It gives researchers a precise idea of the parameters that the moderator variable falls inside when influencing the connection. In order to produce reliable results, the Johnson-Neyman Technique requires a large enough sample size and assumes a linear relationship between the variables. If there are high-order interactions or a nonlinear relationship between the variables, it might not be appropriate (Lin, 2020). In an education study investigating the moderating effect of student self-regulation on the relationship between a technology-based intervention and academic outcomes, researchers may use the Johnson-Neyman Technique to identify the specific levels or ranges of self-regulation at which the intervention has a significant impact on academic outcomes.

2.5 Model for Factoring Mediation and Moderation Variables

Table 1: A model for Factoring Mediation and Moderation Variables

Step	Description	Actions	Indicators
1	Identify the Research Objective	Clearly state the primary variables of interest and the research purpose.	Research objective clearly articulated. Main variables identified.
2	Conduct a Thorough Literature Review	Review existing literature in the field. Identify theories, models, or frameworks related to the research objective.	Comprehensive literature review conducted. Relevant theories/models identified.
3	Analyze Existing Data	If applicable, analyze existing data to identify potential moderation and mediation effects.	Existing data analyzed for moderation and mediation effects. Relationships between variables explored.
4	Brainstorm and Generate Hypotheses	Brainstorm potential moderation and mediation variables based on research objective, literature review, and data analysis (if applicable).	List of potential moderation and mediation variables generated. Hypotheses formulated.
5	Seek Expert Opinions	Consult with experts in the field to gather insights and feedback on potential variables.	Expert opinions sought and considered. Feedback received on potential variables.
6	Collect New Data (If Needed)	Design and implement data collection methods to gather new data, including measures for potential moderation and mediation variables.	Data collection methods designed and implemented. Measures for variables included.
7	Analyze the Data	Utilise suitable statistical methods to examine the gathered information. Examine the impacts of moderation and mediation with tools like SEM and regression analysis.	Analysis of the data for impacts of mediation and moderation. The importance and strength of the links were evaluated.
8	Interpret and Discuss the Findings	Interpret the statistical results. Discuss implications of moderation and mediation variables in relation to the research objective.	Results explained in relation to variables that affect moderation and mediation. Discussion of implications.

Step	Description	Actions	Indicators
9	Consider Limitations and Future Research	Consider the study's shortcomings and any possible confounding factors. Determine what needs to be looked at and researched further in the future.	Limitations of the study identified. Potential confounding variables considered. Future research directions suggested.
10	Communicate the Findings	Present the findings related to moderation and mediation variables in research reports, articles, or presentations.	Findings related to moderation and mediation variables clearly communicated. Research reports or articles written.

Table 1 provides a comprehensive guide for researchers to discover moderation and mediation variables in their study, including the necessary actions to be taken and indicators to measure progress and completion of each step.

Identify the Research Objective: Clearly state the primary variables of interest and the research purpose. In this step, the primary variables and the research purpose are defined. Completeness is indicated by a well-defined research goal and well-identified variables.

Conduct a Thorough Literature Review: Examine the body of research in the area to get ideas and find theories, models, or frameworks that are pertinent. This task entails carrying out an extensive review of the literature. A thoroughly documented literature review and the identification of pertinent ideas or frameworks serve as the completion indication.

Analyze Existing Data: Examine current data, if any, to investigate possible moderating and mediating effects. To find correlations and possible impacts, this process entails analysing the data that is already available. The data analysis for effects of moderation and mediation serves as a completion indicator.

Brainstorm and Generate Hypotheses: List possible variables for moderation and mediation based on the research goal, literature review, and data analysis (if available). Making a list of possible variables and developing hypotheses are the tasks involved in this process. Completion is indicated by a list of possible variables and developed hypotheses.

Seek Expert Opinions: Speak with authorities in the area to get insightful opinions and suggestions regarding possible elements for moderation and mediation. This action entails consulting experts and taking their advice into consideration. The inclusion of professional comments and opinions serves as a completion signal.

Collect New Data (If Needed): Provide and execute data gathering methods to get more information if there is currently existing or inadequate data. This procedure includes developing data collection methods and adding metrics for potential variables. The use of variable metrics in data collection methods is an indication of completion.

Analyze the Data: Utilise suitable statistical methods to examine the gathered information. This task entails looking at relationships and performing statistical analysis. The data analysis for effects of moderation and mediation serves as a completion indicator.

Interpret and Discuss the Findings: Analyse the statistical findings and talk about the moderation and mediation variables' implications. Interpreting the results and going over their implications are part of this action. A comprehensive analysis and explanation of the results pertaining to the variables of moderation and mediation constitute the completion indicator.

Consider Limitations and Future Research: Consider the study's shortcomings, such as any possible confounding variables or restrictions on the statistical techniques that were used. This procedure entails evaluating the available data and pinpointing areas that require additional study. The completion indicator serves as a reflection of its limitations and a guide for future research directions.

Communicate the Findings: Deliver the research findings in publications, presentations, or research papers that address the moderation and mediation variables. This step entails presenting the results in a variety of forms in an effective manner. The dissemination of findings in research reports, journals, or presentations serves as a completion indication.

2.6 The potential benefits of including mediation and moderation variables in education studies.

Including mediation and moderation variables in education studies can bring several benefits and enhance the overall quality of research findings.

Researchers can gain a deeper understanding of the underlying mechanisms and processes that impact educational results by incorporating mediation and moderation variables. By taking into account potential mediating factors that explain the relationship between variables, this strengthens the study's robustness and offers a more thorough knowledge of the phenomenon being studied.

Researchers can evaluate and validate theoretical frameworks or models in education through the use of mediation and moderation analyses. Through

investigating the ways in which specific variables mediate or modify the relationships among others, researchers can enhance the credibility of their findings and lay a more robust theoretical framework for subsequent investigations (McLarnon, 2018).

Researchers can better understand the contextual and border conditions influencing educational processes and results by include mediation and moderation variables. This makes it possible to comprehend when and under what conditions the relationships are true better. Researchers can offer findings that are more broadly applicable to various educational contexts and demographics by taking these aspects into account (Arumugam et al., 2016).

Education is a complicated field where many different elements can affect results. Analyses of mediation and moderation provide a fuller understanding of the intricate dynamics at work. Scholars are able to pinpoint the precise mechanisms by which variables interact or mediate one another, resulting in a more sophisticated comprehension of the educational processes and results under investigation.

Practical ramifications for educational policies and practices may arise from the inclusion of mediation and moderation variables in education studies. Researchers can offer evidence-based suggestions for interventions, programmes, and policies targeted at enhancing teaching and learning by having a thorough grasp of the underlying mechanisms and conditions that impact educational results.

2.7 Challenges and Limitations

Methodological problems, measurement constraints, and the requirement for meticulous data analysis using suitable statistical approaches are the main causes of these difficulties.

One of the difficulties in precisely capturing the effects of moderation and mediation is selecting the appropriate study design. Extensive planning is necessary for studies, considering both the chronological arrangement of variables and potential confounding variables. Additionally, it might be challenging to find and sample individuals who accurately reflect the target community because education studies usually involve a variety of student groups and educational situations.

Measurement of mediation and moderation variables may be challenging. Because inaccurate or faulty measurements might distort the results, researchers must ensure that their measurement instruments are valid and dependable. It is crucial to use established and validated measures and to create and validate new measuring instruments as needed (Sikorskii, 2013).

The investigation of mediation and moderation effects requires a thorough assessment of the pertinent statistical techniques. Researchers must choose the right analytical methods, such as regression analysis, structural equation modelling (SEM), or multilevel modelling, based on the study design and research objectives. Invalid statistical approaches might lead to inaccurate interpretations of the results and compromise their validity.

Sample sizes for education studies are frequently restricted because of access issues or logistical limitations to particular demographics. The statistical power to reliably identify mediation and moderating effects may be limited by small sample sizes. To lessen these constraints, researchers had to take into account techniques like power analysis, effect size estimation, and replication studies (Aguinis et al., 2017).

The existence of various variables and complicated interactions in educational research makes it difficult to establish causal linkages. Even though assessments of moderation and mediation offer insightful information, they are not sufficient to prove causation. To support their theories about causality, researchers ought to take into account other strategies like quasi-experimental techniques or experimental designs (Chambers, 2016).

Contextual factors that impact education include but are not limited to cultural, socioeconomic, and institutional variations. The extent to which the results can be applied to other educational contexts may be restricted by these contextual considerations. The contextual specificity of the study must be acknowledged, and the limitations and application of the findings must be properly interpreted and communicated by the researchers.

3. Implications of this study

3.1 Theoretical Implications

By including mediation and moderation variables, researchers can contribute to the development and enhancement of current theories and models in the field of education. Determining the mediating variables helps to expose the underlying mechanisms through which specific factors affect learning outcomes. The theoretical ideas and their connections are therefore clearer. Finding the boundary conditions and contextual factors that influence the correlations

between the variables is another benefit of studying moderating variables. This develops theoretical frameworks and provides a more nuanced understanding of educational processes.

3.2 Empirical Implications

The addition of mediation and moderation variables strengthens the empirical knowledge base in education. By accounting for these variables, researchers can provide empirical evidence of the moderating and mediating impacts in educational settings. This empirical evidence supports the validity and generalizability of the research findings. Additionally, it enables the identification of specific factors that influence learning outcomes, providing decision-makers, educators, and other education practitioners with pertinent data.

3.3 Practical Implications

The inclusion of mediation and moderation factors in education studies has practical implications for educational interventions and practices. Researchers who understand the mechanisms and conditions that mediate or alter the interactions between variables can provide evidence-based recommendations for improving educational outcomes. This can support the development of targeted interventions, instructional strategies, and policies aimed at enhancing the teaching and learning processes.

3.4 Methodological Implications

Incorporating mediation and moderation variables in education studies requires rigorous methodology and the application of appropriate statistical tools. This has implications for the development of research methodology in the field. Researchers need to utilise strong statistical approaches, appropriate measurement devices, and thorough planning to ensure accurate data analysis. This contributes to the advancement and refinement of methodological approaches to complex educational problem solving.

4. Conclusion

The paper highlighted several key points:

A fuller grasp of the underlying mechanisms and contextual elements influencing educational processes and outcomes is possible thanks to mediation and moderation variables. Through the consideration of these elements, scholars can reveal the intricate dynamics at work and acquire a more thorough comprehension of the topic they are studying.

The robustness, validity, and generalizability of study findings in education are improved by the inclusion of mediation and moderation variables. Researchers can create more reliable empirical evidence and fortify the theoretical underpinnings of their investigations by addressing the possible mediating and moderating effects.

Deeper understanding of the intricate dynamics of educational processes and results may be possible by include mediation and moderation variables in education studies. The creation of evidence-based practices, policies, and interventions targeted at enhancing teaching and learning can be guided by this understanding.

When working with mediation and moderation factors, the study stressed the importance of giving considerable thought to the matter and using proper statistical procedures. To guarantee the validity and reliability of their findings, researchers should address methodological issues such limited sample sizes and measurement restrictions.

5. Recommendations

In light of the conclusions and ramifications covered in the paper, the following recommendations are made:

- Researchers studying education should consider incorporating variables related to mediation and moderation into their studies. This will help create a deeper understanding of the complex dynamics affecting educational practices and outcomes.
- Researchers should carefully assess their research designs and select appropriate statistical approaches when working with mediation and moderation factors. This will ensure that their judgements are reliable and accurate. Collaborating with experts in statistical analysis can be beneficial in this regard.
- The development and validation of measuring instruments intended expressly to capture mediation and moderation variables in education should be the main focus of future study. This will improve the accuracy of data collecting and assist in addressing measurement limitations.
- Collaboration between researchers, lawmakers, and practitioners is crucial in the field of education. When they work together, they may ensure that the real-world implementations of research findings that

include mediation and moderation variables positively impact educational practices and policies.

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