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Article

# Needs Assessment to Impact: Serial mediation model of training effectiveness in Hydropower sector of India

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**Abstract:** Training interventions are important in developing workforce in technical organizations. The paper discusses how the Training Needs Analysis (TNA) affects the Training Effectiveness directly and indirectly, through a serial mediation relationship with Training Content Design (TCD), Instructional Design (ID), Instructional Delivery (IDL), and Training Outcomes. It involved the collection of data on 218 executives in seven hydroelectric plants of Odisha Hydro Power Corporation (OHPC). The serial mediation model was tested using the PROCESS Macro (Model 6) by Hayes. Findings indicate that TNA does not impact greatly on training effectiveness, although it has a high indirect impact via the quality of content design, instructional planning, delivery systems, and perceived training outcomes. Of these variables, the outcomes of the training turned out to be the most powerful predictor of the overall effectiveness, which underlines the significance of the performance-based assessment in the training programs in the public sector. The results indicate that there is a full path of mediation and that training should not be regarded as a single action, but as a system that should be in line with the organizational priorities.

**Keywords:** Training Needs Analysis (TNA), Training Effectiveness, Instructional Design, Training Content Design, Public Sector HRD, Serial Mediation, Training Outcome, Hydro Power

## 1. Introduction

Under such circumstances of fast technological adaptations that culminate in the creation of technology and workforce force, the companies are finding themselves forced to rethink their approach to creating and retaining talent. Training of employees is no longer a norm in the private and the public sector. It is believed to be a major flexibility tool in the businesses, and not a sidelining functionality. The pressure is even higher in the case of the enterprises of this sort in the public sector. In third world countries, accountability, efficiency, and service delivery have become necessitated in a time of scarce resources and increased demands (OECD, 2021). The success of such training activities cannot be left to conjecture that it ought to be quantifiable, strategic, and operational objectives. Training needs Analysis (TNA) is also as essential as ever in a training system; it is the foundation. An effective TNA is able to identify performance weaknesses and foresee future competencies demands in real-time, and therefore put the effort into investing in training to talk directly to their organizational problems (Alagarajan and Shuck, 2015; Goldstein and Ford, 2002). But since this is very theory conscious, in practice, most organizations are not in a position to trace the actual disparity between TNA training and its results or long-term efficiency. Assumptions are numerous, although they appear tacit; Needs analysis needs to yield more, but there are few empirical studies that have methodically examined the channels by which this happens, especially in operationally modern settings in the public sector, such as the hydro power sector of India.

The example of Odishi Hydro Power Corporation (OHPC) creates a good and one-of-a-kind chance to research this dynamic. OHPC is largely dependent on the technical prowess and dexterity of the labor force in its work in remote regions like Malkangiri, Koraput and Kalahandi in geographically different locations of the western Odisha Sambalpur region. Training has been included as common talent training to lower to high level trainees in the

organizations and more specifically to middle to upper management personnel whose role is to execute projects, to ensure a safety and continuity of operations. Despite this investment, there has been minimal internal analysis of effectiveness of training and what are the most crucial things important to its success.

The purpose of this research thus is to solve the question in how training needs analysis affects Learning, Effectiveness, not only directly but indirectly through a string interlinked constructs which are Training Content Design (TCD), Instructional Design (ID), Instructional Delivery (IDL), Training Outcomes (TRG_OUTC). As per the assumption that the training theory that underlies the effects of the training efficacy is a compounding and gradual process (Salas et al., 2012), the research will aim to find out whether TNA on its own suffices or TNA, via the mediation mechanism, will be the quality of design and delivery processes ensured. Specifically, this study will aim at investigating the degree to which TNA is a predictor of the effectiveness of organizational training at a direct level. layout of OHPC. It further asks whether training content designing and educational planning play important mediating roles in this relationship. Besides, it also examines the contribution of instructional delivery to training effect and finally, whether the final state of the outcome is the best predictor of perceived effectiveness itself. The study addresses a significant gap in the literature by modeling such by empirically establishing sequential correlations to make practical recommendations on how to improve training systems utilised by government-managed business entities. In this meaning, the primary research question that will guide this study is, How does training needs analysis affect training effectiveness in a public-sector utility; and through what sequential mediators training content design, instructional design, instructional delivery, and training outcomes; do these affect manifest? This is the question that has been used to base the investigation and the empirical study of the entire training pipeline at OHPC has been organized.

### *1.1 Scope of the Study*

This paper dwells upon the connection of Training Needs Analysis (TNA) and Training Effectiveness within such organization as Odisha Hydro Power Corporation (OHPC), a state-owned utility, which produces hydropower in Odisha. The research simply examines executives in seven leading hydro projects in various districts like Sambalpur, Malkangiri, Angul, Koraput and Kalahandi. To a few reasons is the limited scope considered to be OHPC. To begin with, the organization is a structured process-based organization in the public sector, where training is not only a compliance issue, but also a developmental requirement. Second, the different geographic locations of the plants provide a greater insight into training process operational conditions in a great diversity of sites, distant sites and easier to reach hubs. Only in-house training programs that are planned, implemented, and assessed at the organization are examined in the research; the external certification or the training programs that are sponsored by the companies are not addressed. The training that had been conducted within the last two years as well as formal needs assessment processes were considered only.

Moreover, the middle and senior corporate leaders are analyzed only because they are more used to the strategic training interventions and better placed to tell whether the interventions have been effective. Nevertheless, although this paper specifically examines training systems in a state-owned hydropower utility industry in Odisha, the processes identified here are a far larger one. Infrastructure, energy, transportation, water management, or other technically intensive sectors of the public sector many such organisations use similar structured training pipelines, beginning with a needs assessment and progressing through content, instructional, delivery and outcome assessment. These cascading effects in the present research could thus be applied to other types of utility in the economy or government-related business that require organised in-house trainings to achieve technical skills and operational effectiveness. Although the organisational cultures and regulatory environments might vary, the logic of the integrated training design can probably be applicable to the similar settings where training is viewed as process and not as the one-time intervention. This will allow the results to be insightful in terms of action beyond OHPC, especially to those public agencies with limited budgets and complex technical systems.

## 2. Literature Review

TNA is viewed as an elementary process of any organised training system since it reveals the areas of performance shortage and anticipates future competence needs. TNA has been the analytical gap that explains the lack of connection between organizational objective and the investigation of the disconnection between what the employees know and what they should know to become effective performers (Goldstein and Ford, 2002). The literature has continually discovered that companies that embrace systematic needs evaluation systems are more likely to promote a greater level to which training interventions align with demands of a position (Alagarajanand Shuck, 2015). However, needs analysis can only work when it is converted into realistic training design decisions. A design of the

training material that describes how it should be learned, as it should be taught, and how it will be integrated in the workplace is an important factor as an intermediary in this translation experience. However, according to critics, proper Training Content Design (TCD) has to be based on adult learning principles, situational relevance, and intelligibility such that it is meaningful and meaningful to employees (Knowles et al., 2011). Relevance of content has been shown to enhance the engagement of learners, in addition, training design influences of course whether the needs detected at all become coherent learning contents (Piskurich, 2015). These findings show that TNA guides training, but the quality of the training design determines whether the needs identified at all become coherent learning materials. An analysis of needs, unless constructed correctly, may easily turn into an administrative exercise that has little impact on learning outcomes.

Instructional Design (ID) contributes significantly to organization of learning since content is created. The analysis, design, development, implementation and evaluation models can be helpful in making sure that training materials are rational and pedagogically proper (e.g. Branch, 2009). Merrill (2002) and Clark and Mayer (2016) also state that the instructional design, which incorporates cognitive concepts of learning, allows students to have a better grasp of the material, as well as apply it to the actual workplace environment more effectively. Where the design of training is conveyed to learners, this is referred to as Instructional Delivery (IDL) and this is achieved by way of facilitation, teaching techniques, and conditions of learning. The methods of teaching and delivery are different and less classical classes and workshops and more simulation learning, blended learning and digital modalities (Bell and Kozlowski, 2008). Quality of delivery is important yet quality of delivery is greatly dependent on the quality of previous stages of design. Delivery as described by Grossman and Salas (2011) is a mediator between the planning of instruction and the learning outcomes, in case the content or the design do not foster the interest, even the best delivery capabilities will not be able to compensate the difference. Which results in the learning outcomes that are the actual results of training in the form of acquisition of knowledge, development of skills or change of behaviour. These findings have a close relationship with the second and the third level of the Kirkpatrick Model which deals with learning and behaviour change (Kirkpatrick and Kirkpatrick, 2006). According to scholars such as Baldwin and Ford (1988), the effectiveness of training will ultimately depend upon whether the students will be able to transfer such outcomes to their work activities. It is therefore a chain of events whereby the content design will dictate the instructional schemes which will in turn dictate the way education is delivered and lastly dictate the way education is delivered. However, investigation available is founded on training design and its assessment.

Despite the significant amount of literature dedicated to the training design and evaluation, existing studies reveal that there is still a high number of gaps related to the quality of training in the public sector, particularly, when it comes to the technically oriented sectors, like hydropower utilities. To begin with, the major part of the training systems are considered independently in most of the studies, i.e., TNA alone, delivery and outcomes only but not specifying how interaction between the two are cumulative, process-driven. Little empirical evidence has been developed to support the relationship of whole-chain relationships between needs analysis and outcomes and overall effectiveness in a single integrated model. Second, it is more complex in the context of the public sector. Compliance and regulations, resources, and operational safety have to be balanced, and very narrowly focused, technically specific training interventions are required in the public utilities. Nevertheless, the available studies including explicit research on training systems in Indian public sector undertakings (PSUs) remain very scarce. Hydropower industry is one of the contexts that have not been studied in detail where business continuity and safety can be influenced by the inadequacy of training. Third, serial mediation-oriented solutions to gain an impression of the flow of early training decisions through content design, instructional planning, delivery, and outcomes is highly restricted. The majority of training evaluation models remain theoretical that is not evident in practical organizational contexts. It is possible to address these weaknesses, which makes this study potentially useful in the literature, by empirically examining a complete serial mediation model on a government-owned hydropower utility. It gives a unified knowledge of TNA and its influence on the whole training pipeline giving theoretically stable and operationally sensible inputs that can be used to expound the elaborate complex enterprises in the society. Using the literature reviewed, the work in this thesis proposes a conceptual model in which Training Needs Analysis Influences Training Effectiveness, directly, and through a mediating set of factors, namely Training Content Design, Instructional Design, Instructional Delivery, and Training outcomes. The model puts training as a sequential, interdependent structure where the upstream analysis choices flow across design and delivery systems to influence the outcome effectiveness. The empirical study is based on this model, which is the serial mediation structure.

## 3. Conceptual Framework

According to theory, the current research shows that training effectiveness is a multi-stage process not only through the first stage which is the identification of the needs of the training, but through the other stages of designing

and delivery of the training which result into the effective outcomes through the translation of that needs into learning outcomes. The influence of Training Needs Analysis (TNA) on Training Effectiveness (TRGEFFE) in this case occurs through a sequence of mediating variables, which include Training Content Design (TCD), Instructional Design (ID), Instructional Delivery (IDL) and Training Outcome (TRGOUTC). This model is a serial mediation format, where the influence of TNA is hypothesized to go through each step, and eventually reaching the perceived success of the training intervention. Hayes PROCESS Macro (Model 6) was used to test the model and it allows an assessment of both indirect and direct pathways. On the basis of this framework, it was generally assumed that TNA would play a major role in training effectiveness, and that the relationship between the two would be mediated by the said constructs on an individual and sequential basis.

Despite the fact that training has been explained as a series of interrelated steps in the theoretical literature, there is very little empirical information that bridges the entire process between TNA and training effectiveness through its intermediary steps especially where the study is concerned with public sector enterprises in India. Most of the past studies consider one or two independent variables and fail to realize the accumulative effect of design, delivery, and outcome to effectiveness. Moreover, there is a dearth of studies based on practical operation as it is in the case of the hydro power sector. The gap in this study is that the research uses a serial mediation model to explore the relationship between TNA and training effectiveness through content design, instructional strategy, delivery, and outcome realization to provide theoretical implications and practical use to structured training systems.

This study contributes to the theory of training evaluation by assuming that training is no longer a sequence of parallel activities, but is a system that is causally relevant, and both transmission and transformation take place in every phase of Training Needs Analysis.

Earlier models such as the four levels model by Kirkpatrick and the ADDIE cycle helps one understand how the elements of training should be designed, yet they are largely descriptive and have not empirically determined how the impact of decisions at the top levels are transmitted through the sequential levels of training. This research bridges that gap by illustrating that the serial mediation model lacks a linear or a piecemeal effect like other researches on TNA, but rather it is a series of interconnected design and delivery systems whose interconnection leads to perception of the outcomes. Moving these sequential pathways, the study moves onwards at two levels of preceding theory: at one, the study assumes that the content design induces the needs analysis to be put into action and at another, the outcome of training becomes a critical turnaround that recreates the quality of design and delivery as perceived efficacy. This multi-stage empirical results into a more reasonable theory of how initial analytical options prove an effective beginning of continuous training which is already approved of in current models, but not proved statistically. Accordingly, we get a more process-oriented, narrower view in the study that justifies existing theories of training evaluation, but also helps enhance the overall comprehension of how actual training systems operate in the real corporate setting. On this basis, the formulation of hypotheses is made:

Much rather, it advocates a theory and paradigm by means of training evaluation that places training not as a sequence of subsequent steps but the system that is causally coherent in which the element of Training Needs Analysis is communicated and altered by each of the steps. Older models such as the Kirkpatrick four-level model and ADDIE cycle are more descriptive in nature and do not give empirical descriptions of the effects of the downstream decision in different phases of the training cycle. This concern is considered in the serial mediation model that is tested in our work that proves that the effect of TNA is not linear or isolated, but the finale of chain of design and delivery mechanisms that results in perception of outcomes. The paper extrapolates such sequential routes of extant theory empirically, tracing the needs analysis as an action vehicle; it demonstrates that content design is the main carrier of needs analysis as an action vehicle; and introduces the training outcome as the determining point between design and delivery quality and a perceived effectiveness. This evidence, at different stages, gives a clue on the improved theoretical explanations on how early analytical decisions affect the final effectiveness of the instruction, a notion that is not reflected in the available models of training, which conceptualize it but do not statistically measure. The research, therefore, has a more advanced process-oriented perspective that supports contemporary theories on training evaluation and develops a more comprehensive perspective of how training systems work in real organizational contexts. The following hypotheses are developed from the model:

**Direct Path Hypotheses**

H1: TNA positively predicts Training Content Design (TCD).

H2: TCD positively predicts Instructional Design (ID).

H3: ID positively predicts Instructional Delivery (IDL)

H4: TCD positively predicts IDL.

H5: TNA positively predicts IDL.

H6: IDL positively predicts Training Outcomes (TRG_OUTC).

H7: TCD positively predicts TRG_OUTC.

H8: ID positively predicts TRG_OUTC.

H9: TRG_OUTC positively predicts Training Effectiveness (TRG_EFFE).

H10: TNA has a positive direct effect on Training Effectiveness.

**Mediation Hypotheses**

H11: TCD, ID, IDL and TRGOUTC mediate the effect of TNA individually on Training Effectiveness. H12: A serial mediation exists between TNA and Training Effectiveness through together TCD, ID, IDL and TRGOUTC. These hypotheses are consistent with the chronological nature of the overall training process as a chain of steps and give the analytical foundation of the testing of the suggested serial mediation model.

## 4. Methodology

This study applied a quantitative research design in analyzing the connection between Training Needs Assessment (TNA) and Training Effectiveness in a serial mediation model of Training Content Design (TCD), Instructional Design (ID), Instructional Delivery (IDL), and Training Outcomes (TRGOUTC). The purpose was to empirically test the presence or absence of an effect of TNA on overall effectiveness of training through the steps of training process that are interconnected in a specific manner. The executives of different operational units of the Odisha Hydro Power Corporation (OHPC) were used as primary data collectors. The purposive sampling technique was adopted, to give diversity in the technical environments of the organisation across the board. Seven hydroelectric projects in particular areas of Odisha were used to draw the respondents: Hirakud Hydro Electric Project (Burla, Sambalpur), Chiplima Hydro Electric Project (Chiplima, Sambalpur), Balimela Hydro Electric Project (Malkangiri), Rengali Hydro Electric Project (Angul), Upper Kolab Hydro Electric Project (Bariniput, Koraput), and Machkund Hydro Electric Project (Onukudeli, Koraput), which is a joint venture with the Government of Andhra Only 218 valid responses were received based on middle and senior-level executives with a history of attending training programmes in the last two years. The questionnaires were used as the method of gathering data, which was supplemented by the use of formal communication channels to assure the confidentiality of the respondents and the voluntary nature of the data collection method. The survey questionnaire was based on the standardised scales that were used before and were modified to the OHPC setting. All constructs (TNA, TCD, ID, IDL, TRGOUTC, TRG_EFFE) were measured on a five-point Likert scale on multi-item statements rated on 1 = Strongly Disagree to 5 = Strongly Agree. Pilot test A pilot test that was conducted involved making a small improvement to enhance clarity, relevancy and internal consistency; these small refinements involved were done on the basis of feedback. The data was analysed with the help of SPSS (Version 26) and Hayes PROCESS Macro (Model 6) that is suitable to model multi-stage, complex mediation pathways. The indirect effects in which the bias-corrected confidence intervals were obtained were created through bootstrapping with 5,000 resamples, which reduced the reliance on the normality assumption and enhanced the inferences. Before the mediation model was run, diagnostic check analysis of the model was undertaken in order to validate the model methodological rigour. Variance Inflation Factors were used to test Multicollinearity. VIF of all of which were less than threshold (5) indicating that there were no issues of redundancy among predictors. The distribution of residual variance was audited to confirm the fact of normality and no serious deviations of the same were found. When combined, these checks confirmed that the data was appropriate in mediation analysis. The final check was on how to interpret direct, indirect and serial indirect effects and magnitude of significant effect sizes in order to confirm the hypothesis in the proposed model.

## 5. Results

**Table 1: Regression Summary**

| Outcome Variable | R | RÂ² | MSE | F | df1 | df2 | p-value |
|---|---|---|---|---|---|---|---|
| TCD | 0.5174 | 0.2677 | 0.3188 | 78.97 | 1 | 216 | < .001 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ID | 0.4149 | 0.1721 | 0.3083 | 22.35 | 2 | 215 | < .001 |
| IDL | 0.6253 | 0.3909 | 0.2429 | 45.79 | 3 | 214 | < .001 |
| TRG_OUTC | 0.6987 | 0.4882 | 0.1657 | 50.78 | 4 | 213 | < .001 |
| TRG_EFFE | 0.775 | 0.6007 | 0.142 | 63.77 | 5 | 212 | < .001 |

A clear and gradual trend in the nature of training processes can be observed in the results of the regression Table 1. Needs Analysis of training leads to the influence on Training Content Design (TCD), which justifies approximately a quarter of its variance (26.8). It implies that the more accurately the requirement(s) are classified, the more organized and helpful the contents become. Practically speaking, the slightest enhancement in the quality of TNA translates into a considerable enhancement in the clarity that the employees possess and applicability that is taken as content. Moving to Instructional Design (ID), the variance is explained 17.2%. Hence they are not able to show a significant determinant of TCD, not TNA. The selection of needs assessment as pedagogy indicates that trainers are more inclined towards quality on content rather than pure in instruction planning. Instructional Delivery (IDL) model explains nearly 39% of the variance which means that quality of delivery is defined by the point at which needs assessment, content design, and instructional planning intersect. Practically, that implies that any of these upstream components, in particular, the content design, must be enhanced. Provides useful feedback on the way sessions are presented. The Training Outcome (TRGOUTC) model was found to predict nearly 50 percent of the variance. This implies that the outcomes are realized in case the information, presentation, and instructional structure are rather well-congruent. Lastly, Training Effectiveness model (TRGEFFE), describes over 60 percent of the variance that majorly stems out of the training results. This has the implication on the part of managers that training is finally determined not on the basis of the stages but on the generalized impact of the stages produced. The combination of these findings underscores training as a system that is related and unites design decisions in the initial phase of design to improve, overall, and larger, more concrete effects at each phase.

**Table 2: Standardized Direct Effects**

| Predictor | Standardized Coefficient (Î²) | p-value |
|---|---|---|
| TNA | 0.111 | 0.0362 |
| TCD | 0.1363 | 0.0239 |
| ID | 0.1272 | 0.0201 |
| IDL | 0.0414 | 0.4765 |
| TRG_OUTC | 0.5284 | 0 |

Table 2, the standardized coefficients, indicates the aspects of the training experience most likely to have a high contribution to the overall efficacy perceptions of the employees. The strongest predictor (TRG_OUTC) was the most powerful (beta=0.53), which suggests that the mechanism through which an individual is measured to understand what he or she has obtained through the program is the most directing as to the extent to which the training makes an individual feel that the training is successful. One unit of the perceived outcome (enhancement) is associated with more than a half point of the perceived effectiveness which is the most effective lever that training leaders possess. The low yet significant coefficients of TNA, TCD, and ID indicate that design factors early in the design are still significant but their impact is significant when they contribute to the outcomes in the future. Such small effects (0.11-0.14) are likely to demonstrate that the further refinement of needs assessment or content change and/or instructional restructuring will only lead to increased perceived effectiveness in case the outcomes are something that employees can observe or practice. Instructional Delivery (IDL) is not very directly effective. The implication of this trend is that delivery cannot be very useful on its own to transform the perception of those who are engaged in it into real-life learning results. To the practitioners, it implies that delivery should not be an isolated entity but rather a deliberate process of creating an outcome based design in such a manner that all the processes involved in the training process will eventually have a tangible outcome to the trainee.

**Table 3: Total, Direct, and Indirect Effects of TNA on Training Effectiveness**

| Effect Type | Effect (Unstandardized) | Bootstrap LLCI | Bootstrap ULCI | Significant |
|---|---|---|---|---|
| Total Effect | 0.3422 | 0.2451 | 0.4393 | Yes |
| Direct Effect | 0.0889 | 0.0058 | 0.172 | Yes |
| Total Indirect Effect | 0.2533 | 0.1421 | 0.3801 | Yes |

The findings in Table 3 explain the way in which Training Needs Assessment (TNA) influences the overall Training Effectiveness (TRGEFFE) when the entire sequence of mediators are put into the equation. Whereas the impact of TNA on the total effectiveness is considerable (0.34), the direct impact is 0.09 considering the mediating variables. It is an indication of that change that the majority of the impact of TNA, or about three-quarters, is mediated by the downstream processes of content design, instructional planning, delivery, and the results which participants receive. The high overall indirect effect (0.25), which is upheld by the fact that the confidence interval does not significantly overlap with zero, confirms that needs assessment can have its impact primarily by an effect on these intermediate mechanisms and not by itself. In other words, pragmatically, a well conducted needs assessment produces only a small number of positive results, in the form of positive perceptions of effectiveness when not systematically built in better content, clearer instructional designs that do generate tangible learning gains through designs and forms of delivery. The message of this mediation pattern is also assumed as the training pipeline is a system that is interrelated where one stage contributes to the value incrementally. To training managers, this means everything: the payback of investing in needs assessment is maximised only when it enables coherent design decisions and is able to introduce results, which can be felt and be utilised in their present jobs by employees.

A structural model of the training effectiveness pathway of Training Need Analysis (TNA), Design of Training Content (TCD), Instructional Design (ID), Instructional Delivery (IDL), and Training Outcome is shown in Figure 1 to mediate the cause-effect relationships between the variables. The path diagram is also motivated by empirical evidence of the PROCESS Model 6 analysis, which in turn corroborates the theoretical framework of the research. The model illustrates that TNA has a direct impact on TCD (b=0.46) and even more visibly than previously (b=0.26) a significant and significant impact on ID. It is analyzed on this finding that training needs recognition has the most influence on stage of content formulation in the initial stages. TCD then impacts ID (b=0.38) and IDL (b=0.24) i.e., that content is constructed as a profound input on the structure of teaching and on how this delivery is provided. Simultaneously, ID influences IDL, which is proven by the higher path coefficient (b=0.48) and this fact proves that the manner in which instruction is designed was the key to how instruction eventually managed to be delivered. Such downstream effects of the model show that the IDL is statistically significant using perceived training outcomes (b=0.25), TCD and ID are directly proportional to TRGOUTCOME (b=0.36, b=0.16, respectively). These interactions support the role of these 3 constructs in the final outcomes of training programs. Lastly, the TRGOUTCOME (b=0.57) is the highest variable affecting TRGEFFIFICACY but this is in line with the regression results that it plays a major role as the proximate factor in its determination of perceived efficacy.

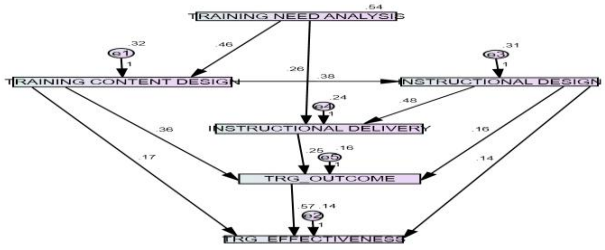


**Fig 1: Path Diagram depicting the structural relationships among training variables**

Figure 1 illustrates the structural model that reveals cause-effect relationships that mediate the pathway between the Training Need Analysis (TNA) and training effectiveness. Design of Training Content (TCD), Instructional Design (ID), Instructional Delivery (IDL) and Training Outcome. This was the result of an empirical finding during the analysis of PROCESS Model 6 and supports the theoretical framework of the study. The model shows that TNA plays a significant role in TCD (b= 0.46) but it is much less and significant in ID (b = 0.26). It shows that the training needs understanding has the least time implications on the content formulation stage. The TCD affects ID (b = 0.38) and also IDL (b = 0.24) which means that the content has been developed as a deep underlying input to both the structure of teaching and the mode of delivery. Simultaneously, ID influences IDL through its higher coefficient of path (b = 0.48), hence demonstrating the key role of instruction design in the ultimate delivery of instruction. Downstream effects in the model indicate that the contribution of IDL to perceived training results is statistically significant (b = 0.25) but both TCD and ID are powerful predictors of TRGOUTCOME (b = 0.36, b = 0.16, respectively). These interactions demonstrate that there is the additive effect of these 3 constructs on the final outcome of the training programs. Lastly, TRGOUTCOME (b = 0.57) is the crucial variable affecting TRGEFFECTIVENESS and compatible to the regression data issue where its major role is a proxy predictor of perceived effectiveness.

In particular, both direct paths of TCD (b = 0.17), ID (b = 0.14), and IDL (b = 0.14) to training effectiveness remain rather moderate. This tendency stresses the mediating role of TRGOUTCOME as the main channel whereby upstream training processes mediate their ultimate effect. The error terms (e1 to e5) define the unexplained variance at each of these endogenous constructs and they exhibit sensible model fit, though with other possible variables ignored. The path model represents a multi-step model of mediation whereby influence of TNA extends to phases of sequential content planning, instructional structuring, delivery, and outcome realisation leading to training effectiveness. These interrelations are not only theoretical but also useful in developing the future trainings within the organizational setup through organizations such as OHPC.

## 6. Discussion

The heavy pace of organisational dynamics within which organisations are increasingly operating with an ever-growing number of organisations, especially of the public sector type, like OHPC and the likes, the investment in employee training is no longer perceived as a periodical formality. They are strategic demands that are likely to lead to material performance changes and organizational stability. The contribution made however is uneven as even with a lot of training programmes being offered out there, the question of why certain training programs are more effective than others is a significant subject of interest: Why are certain training programs more effective as compared to others? Which aspects of the training pipeline are actually critical in enhancing effectiveness? These questions can be answered by the findings of this study. Moreover, another potential part of such an undertaking is by disaggregating Training Needs Analysis (TNA) by disaggregating the multi-layered and multi-faceted ways that the practice facilitates the overall effectiveness of training. Under this interdependent pattern of layered mediation with Training Content Design (TCD), Instructional Design (ID), Instructional Delivery (IDL) and Training Outcomes, the current research underlines that all training requirements are interdependent, therefore, there is a sustained logical system between each single process of the training process. Rather than being different stages, each element will lead on the previous one to create the sum of how competent the entire training ecosystem will become.

Among the most significant conclusions in this work is that TNA has a great, and beneficial effect on TCD. That is in agreement to what we know, and this is any useful training intervention derived out of close and localized analysis of our overall training needs (Brown, 2002). A well-designed TNA is not merely an assurance that whatever it teaches is congruent with organizational objectives but it also explains the extent and significance of the elements that must be conveyed (Garavan, 1991). The strength of this relationship in our model is that it demonstrates the idea that, when training material is designed based on actual/authenticated needs, it has a more favorable base on lower-level procedures like instructional development and execution. Also, there appeared the mediation model which TCD had a significant impact on ID and IDL, which supported cascading influences of content design throughout the training implementation process. This is aligned with a body of research on the importance of good organization of content as a foundation of meaningful instructional structures (Salas, Tannenbaum, Kraiger, and Smith-Jentsch, 2012). The chronological connection between TCD and ID, and to IDL depicts the significance of instructional coherence. This makes it easier to align the two instructional designs in pedagogical styles, and attains greater continuity and effective delivery when such well-structured contents are in place.

Interestingly, the direct effect of TNA on ID was not significant, but it was seen to have an influence with the mediator of TCD. This implies that in practice such as in OHPC, needs analysis by no means need necessarily be translated into instructional plans unless it gets lost in the content design process first. This reinforces the thesis

advanced by Goldstein and Ford (2002) who reiterated the necessity of training design in act as a bridge between needs assessment together with the instruction strategy. The best thing that was learnt throughout the research is that the Training Outcome is important in training effectiveness. These mediators were supported by regression analysis and path model with TRGOUTC the best predictor of TRGEFFE. This conforms with the Kirkpatrick model (Kirkpatrick and Kirkpatrick, 2006), according to which learning effects and behavioral changes are great predictors of their effectiveness (not only the existence of effective programs). Possibly, a confirmative perspective through attested tangible learning results among the participants can be an evaluating prism to gauge the entire training process. The second layer of context is the less direct effect of Instructional Delivery on effectiveness that is moderately related to other mediators. It may mean that, delivery, however, is one of the key elements to be aligned with the content and design of instruction, to formulate profound learning experiences. It was also revealed in past researches that although delivery mechanisms are critical, their efficacy depends more or less wholly on the ability of the learner to associate appropriate delivery and nature of the content (Baldwin and Ford, 1988; Noe, 2010).

The significance of the direct influence of Instructional Delivery (IDL) on Training Effectiveness is not significant, which is an essential piece of information about the knowledge and value of the training to the employee. The most likely reason is that participants will regard delivery as a natural feature of organisational training, the kind of thing that they would be delighted to hear is an automatic addition to their training as opposed to the major component of their perception of effectiveness. Delivery--in practice--only has value where the effects of it are observable and significant results; otherwise, participants may not grant delivery the consequent value. Or in a technical-intensive utility like OHPC, the employees invest in content and quality as opposed to style. A delivery which is more important than a delivery may be given when the thing which is delivered is a complicated, operationally, important thing. This may be one reason that an IDL has a strong impact on the outcome of training, and not necessarily in a direct path to perceived effectiveness. Perhaps, the future research could analyze the possibility of this pattern shifting in training settings that put a much greater emphasis on the quality of facilitation, interaction or learner engagement. Longitudinal studies could also work to determine the importance of delivery in cases where employees are recurrently subjected to blended or technology enabled formats that rely on the capability of facilitators and content flow of instruction.

The implications of the findings on practical level to HR and training departments of the organizations in the public sector are significant. There is a greater emphasis that must be done not just on offering training but also on developing end-to-end training programs which are founded on an organized needs assessment. There is also a need to monitor and evaluate training reactions since they are the most significant predictor of the training effectiveness. This conceptually adds to this literature as it proves that a complex serial mediation model is valid within a real world organization. Although a good part of the literature has been dedicated to linear or isolated mediations, the study supports the significance of evaluating training effectiveness as a multi-stage process through which initial interventions generate a cascading effect on a variety of domains before an effective outcome can be achieved. These new findings are statistically rigorous using Hayes PROCESS macro and the use of this approach in training and HRD research continues.

## 7. Conclusion

This paper has examined the structural relationships between Training Needs Analysis (TNA) and Training Effectiveness in the Odisha Hydro Power Corporation (OHPC) which is a state-owned company. Using the serial mediation, the study examined the associations between intermediate variables Training Content Design (TCD), Instructional Design (ID), Instructional Delivery (IDL) and Training Outcomes - the needs assessment to perceived effectiveness. The results give strong reasons to believe that TNA influences Training Effectiveness on both direct and indirect level, and the strongest impact of TNA has been observed through its mediating effect through training outcomes. The most robust of all the variables predictor of Training Effectiveness was Training Outcome which shows the significance of an outcome-oriented model assessment which is usually overlooked in the organizational training models. The paper, therefore, confirms the effectiveness of training as not due to individually operating factors but due to a working system where need recognition, content design, instruction, presentation, and results are mutually dependent on each other. This brings into focus the need to view training not as an isolated piece of homework, but as a multi-dimensional, multi-faceted process that is based on continual evaluation and should be consistent with organisational goals.

## 8. Practical Implications

The results of this paper provide certain implications to human resources professionals and training managers, particularly in the case of the public sector employer like OHPC. To begin with, Training Needs Analysis (TNA) needs to be established as a strategic priority since the analysis shows that an effective TNA should go hand in hand with the smooth incorporation and refinements of all that will be implemented in the next steps of the training system such as content creation, delivery, and the outcome. In this regard, TNA ought to be integrated in the policy decision-making hierarchy within HRD. And the last element that is as important as the first one is the investment in the Training Content Design (TCD) that will act as a significant gap between the training requirements that are identified and the corresponding instructional delivery models. Every organization must have sufficient resources in order to produce training material that is well organized and contextual. Furthermore, it can be also revealed in the analysis that it is Training Outcome that is primarily predictive of the overall effectiveness of such evaluation models, and that there is the necessity to, however, not merely to monitor inputs but quantify tangible and measurable improvements in skills, behaviors and performance. This necessitates a shift in and refocusing that training is taken as a sequence of disjointed acts rather than a system of community where the interplay of content, delivery and assessment functions is extremely vital. Lastly, this instructional design model implies the visible necessity of capacity building of the internal trainers the pedagogical skills that should be utilized to develop and offer the efficient learning experiences.

## 9. Research Limitations and Future Research

Although the study would provide us with some interesting insights in the mapping of Training Needs Analysis to Training Effectiveness, it does not lack its shortfalls. Results of studies on executives of one specific organization in the public sector cannot be generalised in terms of other sectors, or even levels of hierarchy within the society. Moreover, it is also based on self-reported information and hence can also be subjected to bias, and a cross-sectional design prevents any evaluation of the long-term training outcomes. The studies of the future might require the use of the longitudinal approach, research multiple industries, and consider other factors, such as the support of managers and reinforcement after training. It is also a good prospect to explore further by taking the model to the next level and incorporating digital training environments and making comparisons of traditional and technology-driven approaches.

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