WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Unveiling the Instructional Communication Concept (TCC) Model: A Paradigm Shift in Overcoming Noise in Teaching

[a] Zakari, Muhammad Jamil Ph. D, [b] Tyonyion, Richard Sughnen (Ph. D in View)

[a] Country Federal College of Education (Technical) Keana, Nasarawa State muhdjamilzakari77@gmail.com

[b] Country Depart of Educational Foundations, Instructional Technology, Nasarawa State University, Keffi tyonyion.trs@gmail.com

A B S T R A C T

This paper unveils the Instructional Communication Concept (TCC) Model as a tool for overcoming noise in teaching and learning. It starts by presenting teaching as a communication activity whose efficacy is dependent on a noise-free communication process. To show this a review of the early communication models like the Engineering Communication Model, the SMRC Model, the Schramm Model, and the Early System or Black Box Concept shows that these were either engineering or mass communication models that were introduced to education after the world war II by military personnel with naiveness. Finally, the paper presents the Instructional Communication Concept (TCC) Model- a comprehensive framework designed by Andrew A. Nkom, Professor of Instructional Technology to facilitate a paradigm shift in addressing noise factors in teaching and learning which is built upon interdisciplinary insights and research from communication theories, cognitive psychology, and educational pedagogy, theory, and practice to offers a holistic perspective on instructional communication dynamics. The TCC Model identifies, and gives the teacher the powers to overcome noise through careful analysis of perception, objectives, implementation, communication flow, instructional communication approach, transmission channels, teacher's experience, span of control interface, and the learner's perception

Keywords: TCC Model, Noise, Teaching, Learning, Instructional Communication

1.0 Introduction

In teaching and learning, effective communication between instructor and students sits at the centre of each and every successful teaching and learning experiences. However, amidst the diverse array of factors influencing instructional efficacy, noise – both literal and metaphorical often disrupts this essential channel of communication. From physical distractions in the classroom to cognitive barriers hindering information retention, noise presents a formidable challenge for instructors striving to impart knowledge effectively.

Recognizing the critical need to identify and overcome these noise factors, this write-up unveils the Instructional Communication Concept (TCC) Model - a comprehensive framework designed by Andrew A. Nkom, Professor of Instructional Technology to facilitate a paradigm shift in addressing noise factors in teaching. Built upon interdisciplinary insights and research from communication theories, cognitive psychology, and educational pedagogy, theory, and practice the TCC Model offers a holistic perspective on instructional communication dynamics.

This paper begins by explaining the conceptual foundations of instructional communication, delineating its multifaceted dimensions and inherent complexities. Subsequently, it delves into the pervasive influence of noise within educational contexts, examining its diverse manifestations and detrimental effects on teaching and learning outcomes. Through a synthesis of empirical research and theoretical frameworks, the paper demonstrates the intricate interplay between noise factors and instructional communication processes. Central to the TCC Model is its emphasis on proactive strategies for noise identification and reduction/removal. Drawing upon principles of clarity, coherence, and engagement, the TCC Model offers actionable insights for educators to optimize communication channels and foster meaningful learning experiences amidst noise.

This paper posits the TCC Model as a transformative lens through which teachers can revolutionize their pedagogical approaches, mitigate noise complexities, and cultivate enriched learning environments. By embracing this paradigm shift, stakeholders in education stand poised to usher in a new era of communication-centered teaching practices, empowering both instructors and learners in their pursuit for more productive learning outcomes.

2. Background to the Theory

Effective instructional communication plays a pivotal role in facilitating meaningful learning experiences and fostering student engagement within educational settings (McCroskey, 2007). However, the attainment of this ideal is often impeded by various factors collectively referred to as "noise," which can disrupt the flow of information and hinder the effectiveness of teacher-student interactions (Harris & Monaco, 1978). By noise or noise factor we refer to any interference that would impede the overall effectiveness of communication in teaching.

Historically, research in instructional communication has underscored the importance of clarity, immediacy, and credibility in facilitating effective teacher-student interactions (McCroskey & Richmond, 1987). These foundational principles laid the groundwork for understanding the dynamics of communication within educational contexts, highlighting the essential role of instructors in conveying information accurately and engaging students actively in the learning process.

Nevertheless, the concept of noise within instructional communication has traditionally been narrowly defined, primarily focusing on external disturbances such as noise pollution and classroom disruptions (Richmond & McCroskey, 1992). While these physical factors undoubtedly pose significant challenges to effective teaching, they represent only a fraction of the noise factors within educational environments. In the 20th century, especially after the word war II, the communication models that were introduced in education especially through Educational Technology were equally unable to identify most of the noise factors in teaching. Since their models were not built from insights, research, theories, and principles of education, they only limited learning to the senses of sight and hearing and so could only identify noise in the channel of communication (Nkom, A. A. 2017). In recent years, scholars have increasingly recognized the need for a more comprehensive framework that accounts for the diverse array of noise factors affecting instructional communication. This aligns with Nkom A. A. (1996) as he digs deeper with his deep understanding of the multifaceted nature of noise in education, which encompasses not only external disturbances but also internal cognitive barriers such as teacher's experience, training, curriculum, content, resources, language, pace student's maturity et cetera.

Against this backdrop, the TCC Model emerges as a groundbreaking initiative aimed at redefining the way educators conceptualize and address noise in teaching environments. This model therefore corrects the misconceptions and/or the limitations of the 20th century models of communication that were brought to education to explain the process of instruction with high level of naiveness

Communication Theories and Early Models: Communication theories are frameworks that scholars and practitioners use to understand, explain, and predict how information is conveyed, interpreted, and understood within various contexts. It is a theory that deals with the technology of the transmission of information (as through the written words or a computer) between people, people and machines, or machines and machines

Types of communication

For the purpose of teaching and learning, three types of communication have been recognized, namely intra-personal, inter-personal and non-verbal communication.

Intra-personal communication in line with cognitive theory describes the process by which every human uses the senses to collect information about his/her environment. These senses are the eyes, ears, taste buds, nerve ends and nose all collect information simultaneously for which brain selects which one to pay attention to on the basis intensity, contrast and volume among others things. This information is stored on the basis of information already stored in the brain to arrive at perception or recognition of information (Nkom A. A 2017). Inter-personal communication describes the process in which two or more persons either directly or through any medium or media exchange information together to make common meaning. Teacher to learners and learners to teacher

Early Communication Models

After the World War II, the influx of technology gadgets by the military personnel into education was quite massive and naïve thus, the communication models developed were not based on educational theories and practices but mass communication and engineering models. Let's look at some of the early communication models

Engineering Communication Model

Published in 1948, Shannon–Weaver model describes communication as the interaction of five basic components: source, transmitter, channel, receiver, and destination.

Diagrammatic Presentation of Engineering Communication Model

The Engineering Communication Model in communication had transmitter as the origin of information that was received by a receiver as a radio or television set. Provided the transmitter is working, the message transmitted is deemed to have been received. This model has absolutely no impact in teaching and learning, it lacks interaction and its inability to identify the noise factors, and demonstrates how instructional communication takes place makes no relevance in teaching and learning. In fact, it is a non-human in nature.

SMCR Communication Model

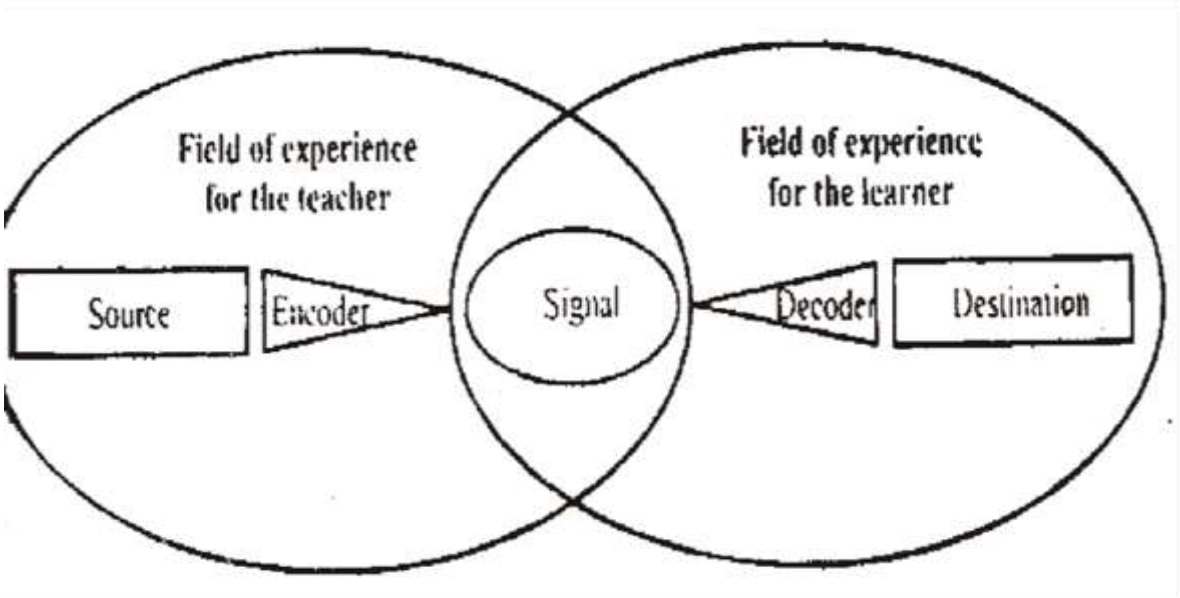
In 1960s, David Berlo, a communication theorist developed the SMCR communication Model. According to him, effective communication can only take place when the sender of a message and its receiver are on the same level or roughly similar. The SMCR which stands for Source, message, channel and receiver is one of the earliest communication models that attempted to specify the content along with the process of communication.

THE SMCR MODEL			
SOURCE (S)	**MESSAGE (M)**	**CHANNEL (C)**	**RECEIVER (R)**
Communication skills	**Content**	**Seeing**	**Communication skills**
Attitudes	**Components**	**Hearing**	**Attitudes**
Knowledge	**Treatment**	**Touching**	**Knowledge**
Social system	**Structure**	**Smelling**	**Social system**
Culture	**Code**	**Tasting**	**Culture**

The model showed source the type of knowledge or message to be transmitted while message showed the specifics of that message. Channel showed the human sense through which each of such messages was to be transmitted while Receiver showed each message reaching its destination or in other words being received as it was transmitted from source

The Schramm Communication Model

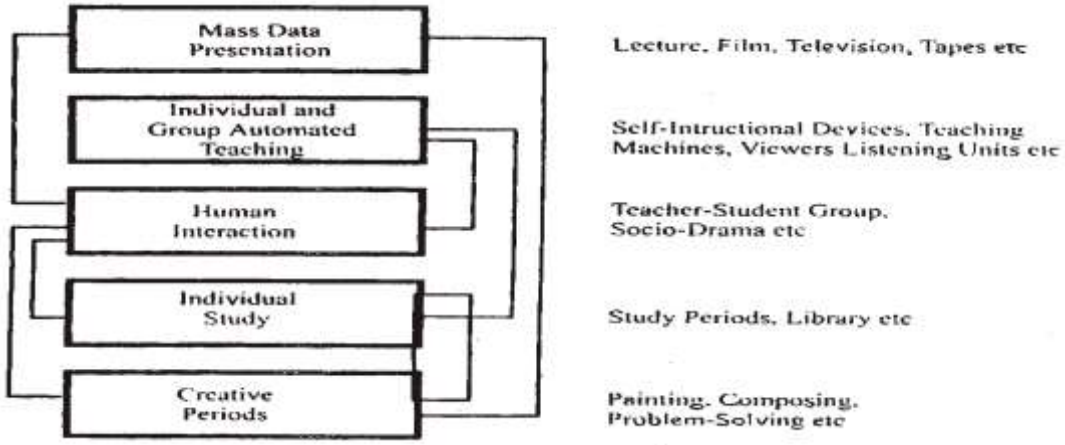
The communication model is explained as a model where communication between the sender and receiver occurs in a circular rather than a linear form as seen in the SMCR Model. The communication model was developed by Schramm in 1954 specific to classroom instruction, therefore it recognized the teacher as the source and learners as destination as well as language as the carrier of the message which first has to be coded by the teacher and then decoded by the learner familiar with the language code. Signal was the mode of transmission and the message having been decoded was deemed to have reached its destination. It shares similar characteristics with the engineering and the SMCR models of communication. This model has reflected the cognitive theory in identifying the two fields of experience that interact to induce learning



The Early System or Black Box Concept

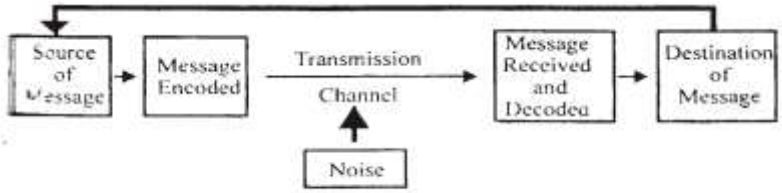
While the Schramm communication model exhibits the normal flow in the process of communication, the early system or black box concept does not. Rather, it has highlighted the interaction involved in communication in instructional situation showing both the activities as well as the human and non-human resources used. In doing so, the model has exhibited the system concept in the fact that these resources complement each other for the purposes of effecting instruction

The Early System or Black Box Concept



Kemp Communication Model

This model of communication is a combination of Engineering model, SMCR model and Schramm models. It has adopted elements from the listed models like source, channel, message, encoder, decoder, and destination. The model has added specifics of transmission to channel and two new concepts: noise and feedback.

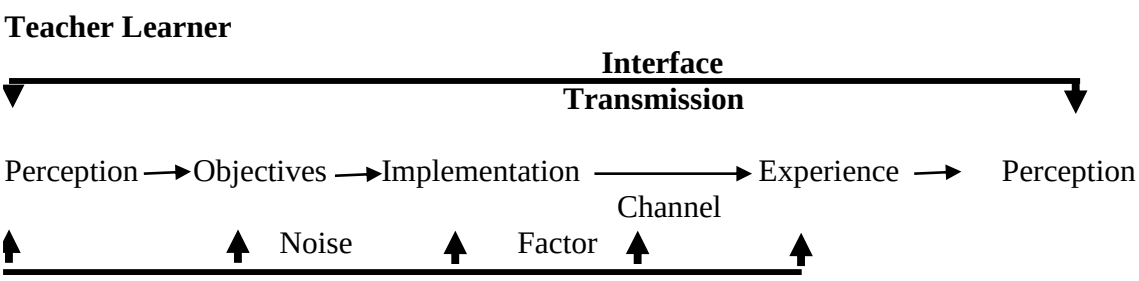


The Instructional Communication Concept Model; the Game Changer

Nkom, A. A with both mass communication and professional teacher background had identified lapses in the Kemp communication model being used as a theoretical communication framework in the postgraduate Diploma in Education (PGDE) programme. Preview of communication model that has continued that the communication models confirmed that the communication model that has continued to be used in definitions of Educational Technology (Wikipedia: 2014) is indeed a mass communication model that is suited for training those to work in mass media. As a one-way and impersonal model utilizing only the two senses of sight and hearing with noise or interference restricted to the two senses, it did not meet the intimate and interactional communication required in a classroom. Research also established that classroom communication is influenced by such factors as; chronological age, maturation, class size, and subject matter, thereby suggesting specialization as the best approach to teachers training. Effectiveness of communication was identified as the key to learning to the effect that the more effective the communication, the better are the chances that learning will take place. These and more lee to the development of the Instruction Communication Concept Model (Nkom, A.A. 1996)

The model essentially expanded the systematic approach of Instructional Technology such as addition of Perception as advanced by St. Augustine's definition as central to all communication and included an Implementation component. The Model has used guidance from earlier principles in components of instructional design with specific formats and templates.

The Instructional Communication Concept Model



The above is the summary of the TCC model on which instructional technology is built to correct the weaknesses of early models. In addition to the Systems Approach to Instruction which is imbedded into the model, it has yet again shown how it can revolutionize teaching and learning. It shows the

communication flow from Perception, Objectives, Implementation, Transmission Channel, and Experience to Perception. The model has also pointed out the noise factor at each and every stage of the communication flow

Communication in the model is between two persons; teacher and learner since learning is an individual activity. It starts from perception by the teacher who formulates objectives and all other components derived from the objectives follow. There is an implementation process in the components that have also been reflected in the systems approach. Message goes through channels, is received and combines with earlier experience to form new knowledge as perception

The unique characteristics of the Instruction Communication Concept Model include that it:

- ✓ It is individual and personal
- ✓ It portrays communication between mental perceptions;
- ✓ It is two-way in origination between teacher or learner;
- ✓ It has immediate feedback in interaction between teacher and learner;
- ✓ Employs all the human senses as apply; sight, hearing, touch, taste and smell;
- ✓ Noise can and does occur across all the components of the process;

The Instructional Communication Concept Model has universal application in being employed in all the methods of instruction; the Lecture in large group instruction; Teaching in small group instruction and in Individual instruction. Interaction and feedback have information originating from either teacher or learner. Noise or interference in the communication process is of particular consideration since it and does occur along the entire process. In Individual instruction the above characteristics of the Model are reflected in: individualized learning materials: the individual working at own pace and convenience; materials prepared for interaction; activities provided for self-monitoring; evaluation and for other purposes. The quality of Individual Instruction lies in appropriate preparation of learning materials in line with above characteristics but the resources are imbedded in the materials provided. In the use of the senses, instruction employs all human senses to the effect to use them for storing what is perceived. This is employed where there is need in learning to make provision for learners or students, apart from sight and hearing, to identify differences in smell, taste and touch; these abilities become useful in everyday living and even in future careers.

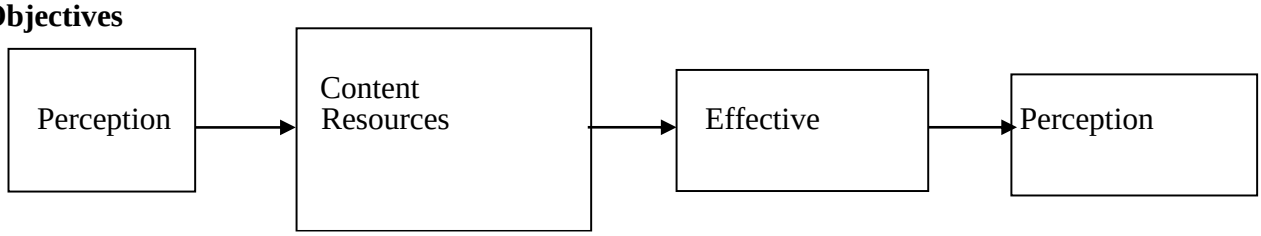
From the foregoing, the TCC Model becomes that sieve to flush out every sense of noise as it critically checks through its components as explained below

Perception: The first stage in the communication flow is the perception of the teacher. We can see that this can be affected by their experience, the level of training and the curriculum which they have to implement. Identifying these possible noise factors makes it possible to mitigate them to enhance more learning outcome. In this way, where the teachers' knowledge or level of training is not as required, the necessary measures are taken, and where the curriculum needs improvement, such is done to remove noise

Objectives: Having picked the topic from the curriculum which is under perception, the lesson plan is drawn. Here the objectives which are the most important part of a lesson plan are drawn based on the educational domains; cognitive, affective and psychomotor domains. To remove the noise factor, these objectives are stated in clear and measurable terms covering the three domains.

Implementation: This is the stage where the lesson is actually presented to the learners. At this stage the teacher uses different strategies to inculcate knowledge. To take care of the noise factor, the teacher is mindful of the content which is from the curriculum, the resources with which the lesson is not made abstract, the language used for effective comprehension. The teacher has to also look carefully at the pace bearing in mind the class, mental and chronological age of the learners. Lastly, the teachers has to examine his personality to appear more appealing and convincing to the learners

The Communication Flow: The Flow presents the component as content of the communication from a teacher's perception. The faithful implementation of each of the components combines to result in Effective Communication to result in Perception in the learner; which is stored as learning



Communication by its nature flows from and between points but in teaching it involves specific components in the concern for its effectiveness. Communication as had been established by St. Augustine in the 4th Century, is a mental activity employing the human senses and must therefore start from perception by the teacher and end with perception by the learner when learning is deemed to have occurred. In between are the components which in their flow from one to the other, promote and ensure effective communication as the means for learning to occur.

The Instructional Communication Approach: The concern for specific aspects in the communication or teaching process as also related to noise control is indicated by the components and sub-components. The Communication Approach provides a comprehensive illustration of all components and

subcomponents to include in the modified systematic approach of instructional technology. Modification is the inclusion of perception and implementation and increase of components from four to six and of sub-components from seven to eighteen for more thorough guidance. The approach provides details in sub-components and also assists in identification of areas of noise.

The Communication Approach: The statement made by this diagram is that effective communication leads to perception or learning by the learner at the centre of the process indicating that teaching is learner centred. However, for effective communication to occur, noise must be removed from each component by presenting it using the guidance provided in the details of the sub-components

Transmission channel: This refers to any means through which information or knowledge is transmitted to learners. Instructional technology has taken learning beyond only two senses of sight and hearing as was experienced in Educational Technology through the Kemp Model. The TCC model in a quest to improve the quality of learning has been backed by research that the more sense organs are involved in learning, the more productive is it. Therefore, we have sight, hearing, touch, taste, and smell

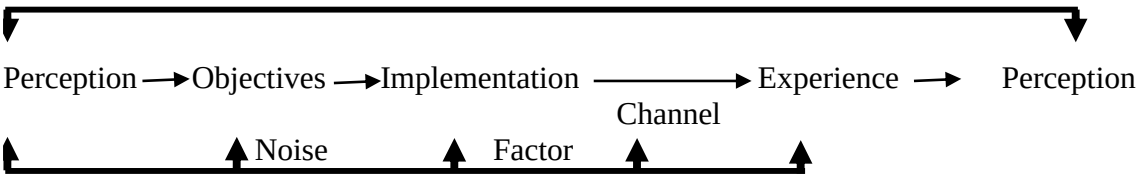
Experience: For effective teaching and learning, the TCC model spells out what could constitute noise from the learners' experience. Here we look at the senses, maturation and the environment in general. Being conscious of these, the teachers should be able to minimize their interference in learning thereby improving the quality of learning

Perception: The perception of the learners plays a vital role in the quality of learning. To enhance quality of teaching and learning, Instructional Technology model has adequately taken care of this

Interface: The interface shows the interaction between the teacher and the learners. It gives the teacher the feedback from which necessary adjustments are made

The Noise Factor: The concept of Noise is identification of any interference that would impede the over-all effectiveness of communication in teaching.

Interface

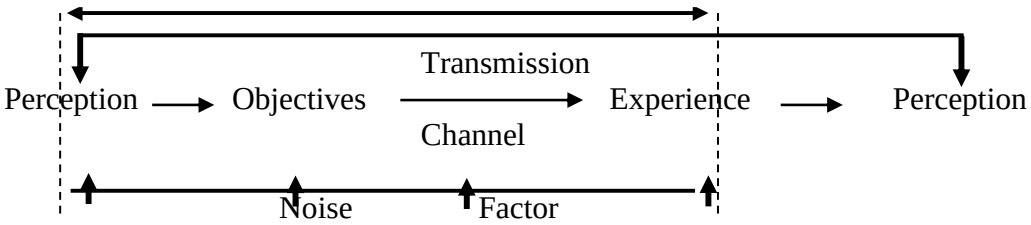


Experience	Cognitive	Content	Sight	Senses
Training	Affective	Resources	Hearing	Maturation
Curriculum	Psychomotor	Language	Touch	Environment
	Useful objective	Pace	Taste	
		Personality	Smell	

Rather than being located only at the transmission channel as indicated by Educational Technology with the use of senses of sight and hearing; the potential of Noise is along the entire communication process. This knowledge therefore should assist in taking steps to eliminate or at least reduce the

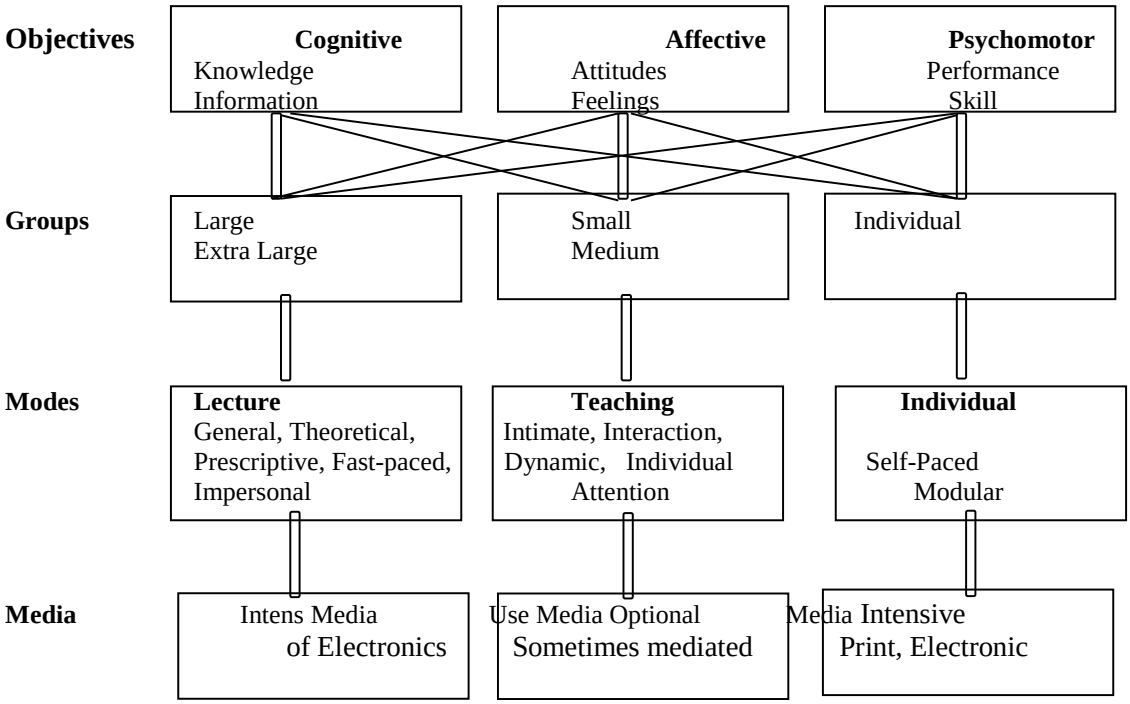
occurrence of interference; as listed below each component. For instance, where relevant, additionally use the senses of touch in texture, taste and smell to identify differences; which are stored in the brain as learnt or experience. Combined with what the learner already knows that is identified by the term 'experience'; this aspect is identified as previous knowledge.

The Span of Control: Span of control shows the components in the system that are under the control or for which the teacher takes decisions



The teacher manages the class with control over many aspects of the communication or teaching process as illustrated in this diagram. There are, as shown in the Noise Factor, areas of potential interference that are under complete or partial control. The teacher has control of decisions on objectives and their construction, content, methods and actual delivery including managing the class. The dotted lines across Perception and Experience indicate items of partial control and in-between are main areas of teacher control. Noise control is vital to the overall effectiveness of the process and learning.

Relatedness: Objectives; Group Size; Method/Mode; and Media



This component confirms and illustrates change in paradigm in instruction from the stress on technology as gadgets in the earlier models and in the concept of Educational Technology to that of focus on communication and systems approach of Instructional Technology. This is seen in the relatedness of components that work together from objectives to media and confirmed by the media being intensive for the large group lecture and in individual learning; small group teaching which is interactional for socialization is optional because based on choice,

Summary

This paper introduces the **Instructional Communication Concept (TCC) Model**, a transformative framework designed to address noise factors in teaching and learning. Developed by Professor Andrew A. Nkom, the TCC Model integrates insights from Research, communication theories, cognitive psychology, and educational pedagogy to optimize instructional communication. The study critiques early communication models (e.g., Shannon-Weaver, SMCR, Schramm) for their engineering and mass communication origins, which inadequately address the complexities of classroom interactions. In contrast, the TCC Model emphasizes a two-way, multisensory communication process between teachers and learners, identifying and mitigating noise across all stages: Perception, Objectives, Implementation, Transmission Channels, and Learner Experience. Key innovations include its focus on teacher-learner interaction, immediate feedback, and the use of all human senses (sight, hearing, touch, taste, smell) to enhance learning. The model's applicability spans large-group lectures, small-group teaching, and individualized instruction, making it a versatile tool for modern pedagogy.

Conclusion

The TCC Model represents a paradigm shift in instructional communication by addressing the limitations of traditional models. It redefines noise not merely as external disruptions but as multifaceted barriers, including cognitive, curricular, and environmental factors that impede effective teaching. By empowering teachers to systematically identify and reduce noise through structured components (e.g., clear objectives, tailored implementation, multisensory channels), the model fosters more productive learning outcomes. Its interdisciplinary foundation and practical adaptability position it as a robust solution for diverse educational contexts, particularly in settings where communication inefficiencies hinder learning.

Recommendations

1. **Teacher Training**:
   i. Integrate the TCC Model into professional development programs to equip teachers and teachers in teacher training schools with strategies for noise identification and mitigation.
   ii. Emphasize multisensory teaching techniques and interactive communication skills.
2. **Curriculum Design**:
   i. Align lesson planning with the TCC Model's components (e.g., measurable objectives, learner-centered implementation) to minimize noise.
   ii. Incorporate adaptive content that addresses varied learner perceptions and experiences.
3. **Policy Implementation**:
   i. Advocate for institutional adoption of the TCC Model in teacher certification and accreditation standards, Colleges of Education, and university programmes
   ii. Fund research on the model's efficacy across different educational levels and subjects.
4. **Technology Integration**:
   i. Develop digital tools (e.g., interactive platforms, feedback systems) that align with the TCC Model's principles.
   ii. Ensure accessibility features (e.g., captions, multisensory media) to accommodate diverse learners.
5. **Future Research**:
   i. Investigate the model's impact in low-resource classrooms and non-traditional learning environments.
   ii. Explore its synergy with emerging technologies like AI and virtual reality.

References

AECT (1977): The Definition of Educational Technology: AECT Task Force on Definition and Terminology; Association for Educational Communication and Technology

Anglin C. Ed (1995): History of Instructional Technology adapted from Instructional Technology: Past, Present and Future; Wikipedia, Retrieved, June 2013

Bittner, J. R (2005) 5th Edition Mass Communication: An Introduction: PRENTICE HALL, Englewood Cliffs, New Jersey; by Heinemann Educational Books, Ibadan

Bligh, D. A., Jacques, D. and Piper, D. W. (1980): Methods in Post-Secondary Education;UNESCO Educational Studies and Documents, UNESCO, Paris

Brown, J. W., Lewis, R. B., and Harclewood, F. F.: (1977); 5th Edition. AV Technology, Media and Methods; McGraw-Hill Book Company, New York

Eble, K. E. (1975): The Craft of Teaching: A Guide to Mastering the Professor's Art; Jossey Bass Publishers, San Francisco.

Flynn, J. E. and Seagil A. W. (1970) Architectural interior systems: Lighting, Air-conditioning, Acoustics; New Jersey Van Reinhold

Myers, S. A. (Google docs. 2011) Instructional Communication: The Emergence of a Field.

Nkom, A. A. (2000): Instructional Communication for Effective Teaching in University; Education; BI-SHAANN Publishing, Kaduna

Nkom, A. A. (2008) General Methods for the Professional Teacher: A Training Manual; BI- HAANN Publishing, Kaduna.

Nkom, A. A.: (2012) Instructional Communication: Expansion in Communication Theory; International Journal of Instructional Technology and Distance Learning; Vol. 9, No 1, 2012 pp. 49-63

Nkom, A. A. (2013) Instructional Communication: Challenges of the Twenty First Century; International Journal of Instructional Technology and Distance Learning; Vol. 10, No 7, 2013 pp. 29-38

Nomenclature

Aradius of

Bposition of

Cfurther nomenclature continues down the page inside the text box

Structure

Files must be in MS Word only and should be formatted for direct printing, using the CRC MS Word provided. Figures and tables should be embedded and not supplied separately.

Please make sure that you use as much as possible normal fonts in your documents. Special fonts, such as fonts used in the Far East (Japanese, Chinese, Korean, etc.) may cause problems during processing. To avoid unnecessary errors you are strongly advised to use the 'spellchecker' function of MS Word. Follow this order when typing manuscripts: Title, Authors, Affiliations, Abstract, Keywords, Main text (including figures and tables), Acknowledgements, References, Appendix. Collate acknowledgements in a separate section at the end of the article and do not include them on the title page, as a footnote to the title or otherwise.

Bulleted lists may be included and should look like this:

First point

Second point

And so on

Ensure that you return to the 'Els-body-text' style, the style that you will mainly be using for large blocks of text, when you have completed your bulleted list.

Please do not alter the formatting and style layouts which have been set up in this template document. As indicated in the template, papers should be prepared in double column format suitable for direct printing onto paper with trim size 210 x 280 mm. Do not number pages on the front, as page numbers will be added separately for the preprints and the Proceedings. Leave a line clear between paragraphs. All the required style templates are provided in the file "MS Word Template" with the appropriate name supplied, e.g. choose 1. Els1st-order-head for your first order heading text, els-abstract-text for the abstract text etc.

Tables

All tables should be numbered with Arabic numerals. Every table should have a caption. Headings should be placed above tables, left justified. Only horizontal lines should be used within a table, to distinguish the column headings from the body of the table, and immediately above and below the table. Tables must be embedded into the text and not supplied separately. Below is an example which the authors may find useful.

Table 1 - An example of a table.

An example of a column heading	**Column A (*t*)**	**Column B (*t*)**
And an entry	1	2
And another entry	3	4
And another entry	5	6

Construction of references

References must be listed at the end of the paper. Do not begin them on a new page unless this is absolutely necessary. Authors should ensure that every reference in the text appears in the list of references and vice versa. Indicate references by (Van der Geer, Hanraads, & Lupton, 2000) or (Strunk& White, 1979) in the text.

Some examples of how your references should be listed are given at the end of this template in the 'References' section, which will allow you to assemble your reference list according to the correct format and font size.

Section headings

Section headings should be left justified, bold, with the first letter capitalized and numbered consecutively, starting with the Introduction. Sub-section headings should be in capital and lower-case italic letters, numbered 1.1, 1.2, etc, and left justified, with second and subsequent lines indented. All headings should have a minimum of three text lines after them before a page or column break. Ensure the text area is not blank except for the last page.

General guidelines for the preparation of your text

Avoid hyphenation at the end of a line. Symbols denoting vectors and matrices should be indicated in bold type. Scalar variable names should normally be expressed using italics. Weights and measures should be expressed in SI units. All non-standard abbreviations or symbols must be defined when first mentioned, or a glossary provided.

File naming and delivery

Please title your files in this order 'procediaacronym_conferenceacronym_authorslastname'. Submit both the source file and the PDF to the Guest Editor.

Artwork filenames should comply with the syntax "aabbbbbb.ccc", where:

a = artwork component type

b = manuscript reference code

c = standard file extension

Component types:

gr = figure

pl = plate

sc = scheme

fx = fixed graphic

Footnotes

Footnotes should be avoided if possible. Necessary footnotes should be denoted in the text by consecutive superscript letters[1]. The footnotes should be typed single spaced, and in smaller type size (7pt), at the foot of the page in which they are mentioned, and separated from the main text by a one line space extending at the foot of the column. The Els-footnote style is available in the MS Word for the text of the footnote.

Please do not change the margins of the template as this can result in the footnote falling outside printing range.

Illustrations

All figures should be numbered with Arabic numerals (1,2,3,….). Every figure should have a caption. All photographs, schemas, graphs and diagrams are to be referred to as figures. Line drawings should be good quality scans or true electronic output. Low-quality scans are not acceptable. Figures must be embedded into the text and not supplied separately. In MS word input the figures must be properly coded. Lettering and symbols should be clearly defined either in the caption or in a legend provided as part of the figure. Figures should be placed at the top or bottom of a page wherever possible, as close as possible to the first reference to them in the paper.

The figure number and caption should be typed below the illustration in 8 pt and left justified [***Note:*** one-line captions of length less than column width (or full typesetting width or oblong) centered]. For more guidelines and information to help you submit high quality artwork please visit:http://www.elsevier.com/wps/find/authorsview.authors/ authorartworkinstructions. Artwork has no text along the side of it in the main body of the text. However, if two images fit next to each other, these may be placed next to each other to save space. For example, see Fig. 1.

Fig. 1 - (a) first picture; (b) second picture.

Equations

Equations and formulae should be typed in Mathtype, and numbered consecutively with Arabic numerals in parentheses on the right hand side of the page (if referred to explicitly in the text). They should also be separated from the surrounding text by one space.

[1] Footnote text.

$$\rho = \frac{\overset{\nu}{E}}{J_C(T=\text{const.})\cdot\left(P\cdot\left(\frac{\overset{\rho}{E}}{E_C}\right)^m+(1-P)\right)} \quad (1)$$

4. Online license transfer

All authors are required to complete the Procedia exclusive license transfer agreement before the article can be published, which they can do online. This transfer agreement enables Elsevier to protect the copyrighted material for the authors, but does not relinquish the authors' proprietary rights. The copyright transfer covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microfilm or any other reproductions of similar nature and translations. Authors are responsible for obtaining from the copyright holder, the permission to reproduce any figures for which copyright exists.

Acknowledgements

Acknowledgements and Reference heading should be left justified, bold, with the first letter capitalized but have no numbers. Text below continues as normal.

An example appendix

Authors including an appendix section should do so before References section. Multiple appendices should all have headings in the style used above. They will automatically be ordered A, B, C etc.

Example of a sub-heading within an appendix

There is also the option to include a subheading within the Appendix if you wish.