ACADEMIC ENGLISH PROFICIENCY AND STEM LEARNING OUTCOMES: THE ROLE OF AI

PROF. NANCY MBAKA, PhD.

CHUKA UNIVERSITY

OUTLINE

- Academic English Proficiency
- STEM Learning Outcomes
- The Role of AI

ACADEMIC ENGLISH PROFICIENCY

- Language mediates all learning

- English is considered the language of Science and Technology all over the world.

- In Kenya it is the language of Instruction from Grade five to University. It is learned in school as a second language

- This is critical in educational systems where the students learn English as a second language (ESL) –Kenya.

- Cummins (1979) differentiated between Cognitive Academic Language Proficiency (CALP) and Basic Interpersonal Communication Skills (BICS).

- CALP involves the cognitive ability to understand and synthesize abstract concepts, higher-order thinking, and subject-specific vocabulary. It's important for understanding textbooks, exams, classroom instruction, and academic discourse,
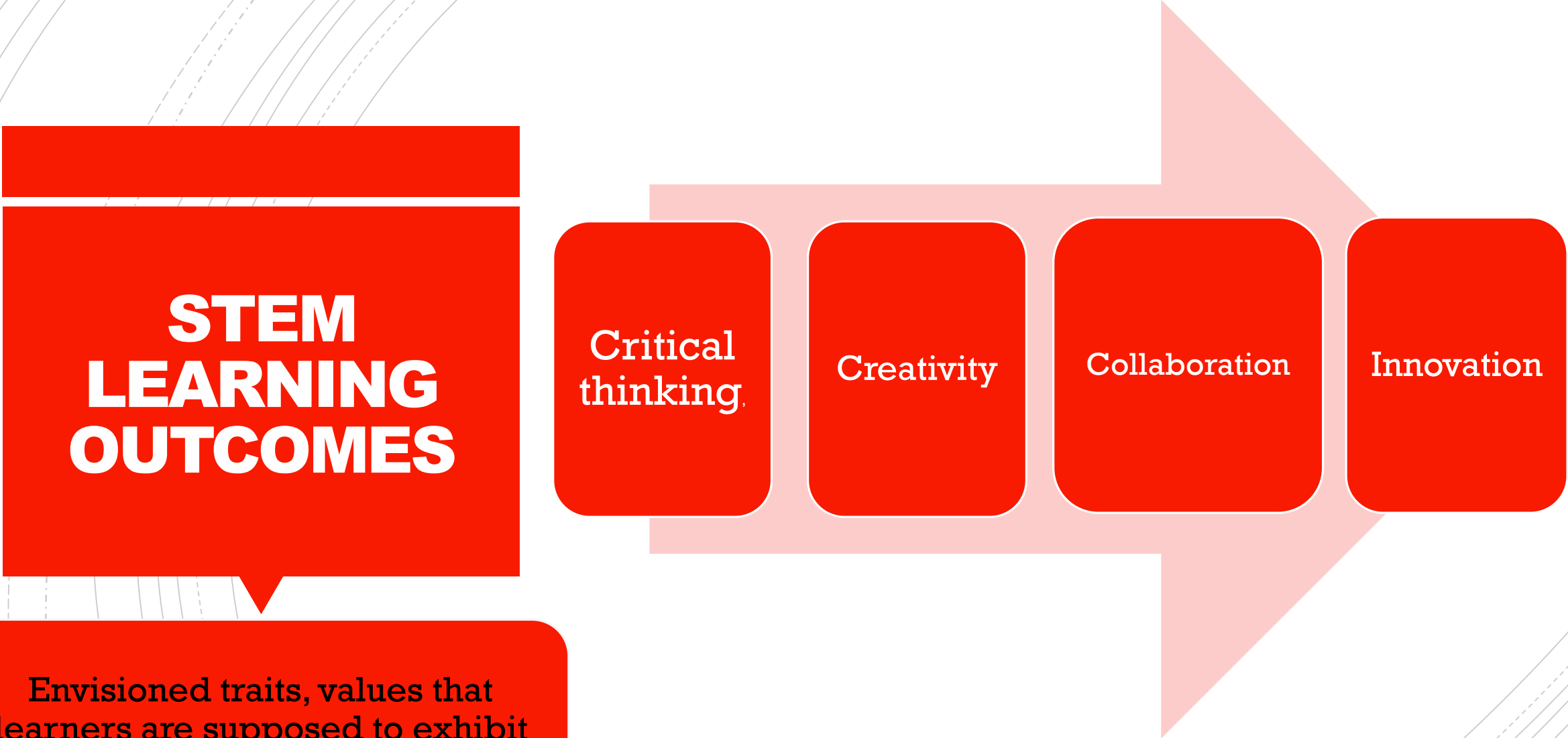
CALP Vs BICS

CALP

- Used in formal academic learning
- Required to succeed in academic settings
- Cognitively demanding
- Topics are abstract
- Subject specific Register/ Jargon

BICS

- Used in informal conversation settings
- Required in interpersonal relationship settings
- Cognitively undemanding
- Topics are concrete and make sense
- Everyday vocabulary

Critical Thinking

Clear, rational, and independent evaluation of information to improve thinking.

- Critical thinking, according to Paul and Elder (2010), involves improving one's thinking by actively managing its structure and applying intellectual standards: Three items-

- The intellectual standards that should be applied to the elements of reasoning

- The elements of thought (reasoning)

- The intellectual traits associated with a cultivated critical thinker that result from the consistent and disciplined application of the intellectual standards to the elements of thought

Paul-Elder Critical Thinking Model

Intellectual Standards

Accuracy	Precision
Clarity	Depth
Relevance	Significance
Logical	Fairness
Sufficiency	Breadth

Must be applied to

Elements of Reasoning

Purposes	Inferences
Questions	Concepts
Points of view	Implications
Information	Assumptions

Intellectual Traits

Humility	Perseverance
Autonomy	Empathy
Fair-mindedness	Integrity
Courage	Confidence in reasoning

to develop

CREATIVITY

- **Definition:** Process that results in products that are novel and useful- used in a nominal sense. The nominal sense of activity as a name referring to dynamic movements, changes, or processes, rather than the adjectival sense referring to the attribute of a person's level of active-ness, carries its verb root (i.e., act).

- This root makes it an action noun, such that it does not refer to an ordinary kind of static thing; the thing it refers to is itself a dynamism.

Distinguishing the Types of Creativity

Creativity as Process

Creativity as a nominal term;
names the process(es) that constitute creativity

Definition:
A process of **internal attention constrained by a generative goal**, often involving other cognitive, perceptual, emotional, or motoric operations
(the process definition)

e.g., "Keeping an open mind can help creativity happen."

Creativity as Attribute ("Creative-ness")

Creativity as an adjectival term;
describes a thing that has creative attributes

Attribute of an agent

Definition:
Ability or tendency to generate creative output via creative processes

e.g., "Before we hire an engineer, we evaluate their creativity."

Attribute of an output

Definition:
Having novel and useful function or effect

(the product definition)

e.g., "The creativity of this invention is truly remarkable."

COLLABORATION

- **Definition**: is working together by sharing knowledge, skills, and resources to achieve a common goal.

- Encouraging team collaboration on various tasks allows companies , institutions and academicians to make unified decisions and increases their chances of success.

- When your people join forces in brainstorming sessions or cross-functional project teams, the work/academic environment promotes growth and innovation for team members and the company /institution as a whole

Types of collaboration

Internal and external

Cross-functional

Virtual and in-person
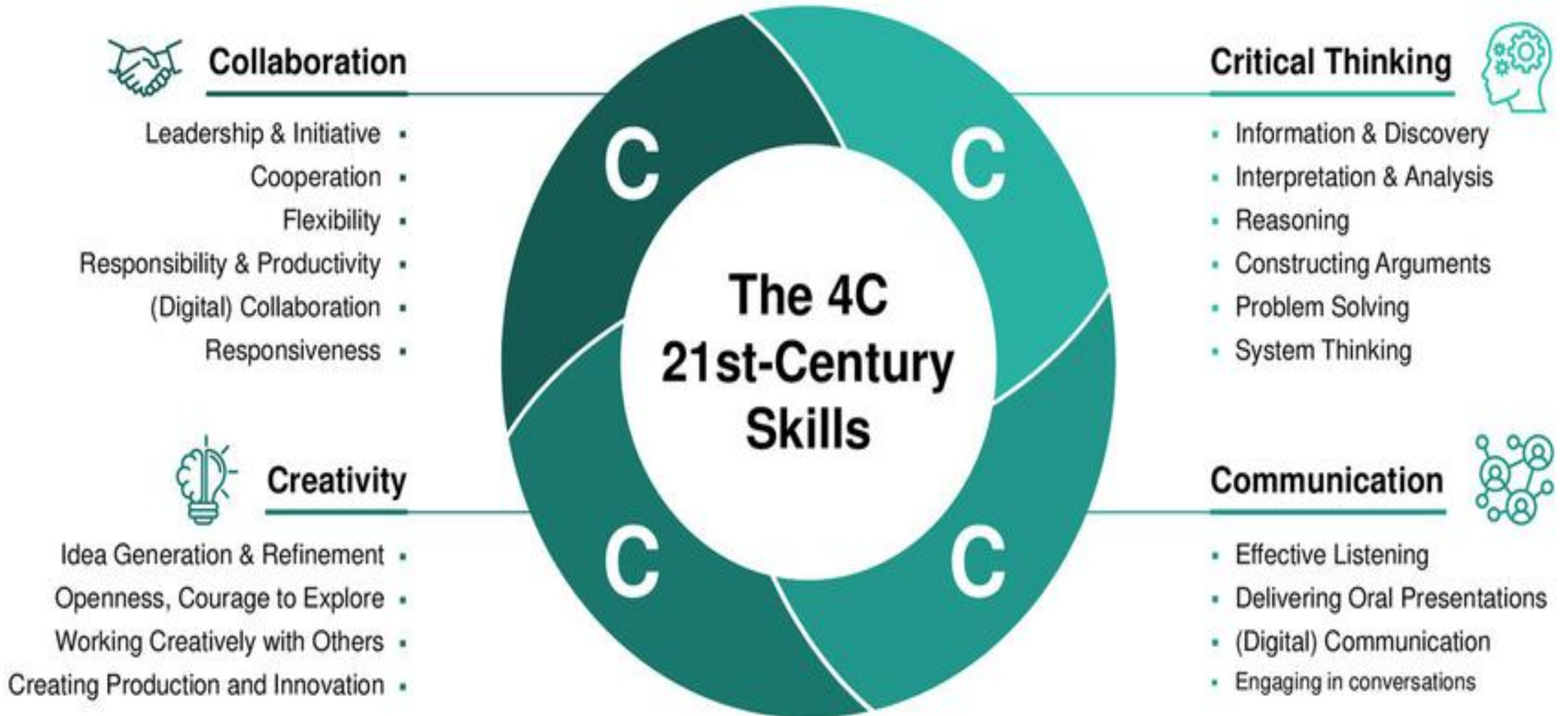
Community

Team

Social

Contextual

INNOVATION

- **Definition:** bringing about new ideas, methods, products, services, or solutions that have a significant positive impact and value.

- It involves transforming creative concepts into tangible outcomes that improve efficiency, and effectiveness, or address unmet needs.

- Innovation is not limited to technological advancements and encompasses novel approaches to problem-solving, processes, organizational practices, or business model innovations.

- At its core, innovation involves challenging the status quo, thinking outside the box, and taking calculated risks to drive progress and achieve breakthrough outcomes.

EXAMPLES OF INNOVATIONS

- **Airbnb:** Airbnb disrupted the traditional hospitality industry by creating an online marketplace that allows individuals to rent out their homes or spare rooms to travelers. This peer-to-peer accommodation model provided an alternative to traditional hotels and revolutionized the way people travel and experience accommodations.

- **Netflix's Streaming Service:** Netflix disrupted the traditional video rental and television industry by introducing a streaming service that allows users to watch movies and TV shows on demand. This innovation led to a shift in how content is consumed, paving the way for other streaming platforms.

- **Mpesa**-Kenya's mobile money transfer has revolutionalised business and lives by disrupting money transfer models

- **Huduma centre**- all government services under one roof

SUMMARY OF STEM OUTCOMES

Collaboration

- Leadership & Initiative
- Cooperation
- Flexibility
- Responsibility & Productivity
- (Digital) Collaboration
- Responsiveness

Critical Thinking

- Information & Discovery
- Interpretation & Analysis
- Reasoning
- Constructing Arguments
- Problem Solving
- System Thinking

Creativity

- Idea Generation & Refinement
- Openness, Courage to Explore
- Working Creatively with Others
- Creating Production and Innovation

Communication

- Effective Listening
- Delivering Oral Presentations
- (Digital) Communication
- Engaging in conversations

The 4C 21st-Century Skills

C C C C

AI TOOLS AND STEM LEARNING OUTCOMES

- AI tools are available to aid students in learning STEM subjects including carrying out **virtual science experiments**

- Intelligent tutoring systems for students are particularly useful in challenging STEM fields e.g. **photo math**- helps one solve a math problem step by step

- AI tools for teachers that help in creating content and course outlines are also available e.g. **co-pilot education**

- NB: These tools are very many. It is up to us to explore them now that we are being exposed

AI TOOLS AND ENGLISH LANGUAGE PROFICIENCY

- Many AI tools have been created to help students in their English proficiency , that is CALPS

- AI tools can help the learner learn a language e.g. **duolingo**

- AI tools help us check grammatical correctness, e.g. **Grammarly**

- They can also help us create content , e.g., **Chat GPT**

- They are of help to the teacher too in developing course outlines, content and in assessment

- Two of them are of interest because they can generate essays with standards close to publication articles: **Co-Storm AI and Samuel AI**

CO-STORM AI (STANFORD)

Tool for Research Management

- **Origin**-CO-STORM AI was developed by a team of researchers and computer scientists at Stanford University to assist scholars and students in organizing their research, writing, and publication processes more efficiently.

- The tool was designed with the goal of reducing the cognitive load involved in writing complex academic papers by automating certain aspects of the writing process and providing recommendations based on AI analysis of large datasets of academic content.

THEORETICAL FRAMEWORK: ONTOLOGICAL IMPERATIVE FRAMEWORK

The 5 guiding questions in the ontological Imperative Framework

1. What digital tools , systems and services are at play in teaching? Who created them and why.?

2. What data do these digital tools, systems and services render?

3. What limitations might there be to the data rendered via these digital tools, systems and services?

4. What are the epistemological implications of this ontological analysis?

5. What are the axiological implications of this ontological analysis?(Gerber,2022).

CO-STORM AI

Affordances

- Time Efficiency : within minutes

- Enhanced Quality of Writing

- Improved Research Management/Literature Review

- Support for Novice Writers

- Collaboration and Team Writing

- Helps researchers to identify the research gap faster

- Reduces the grammatical errors that one is likely to make

- Can help to clear the writers block

- Helps in managing extensive information

- Helps in bringing focus in research

CO-STORM AI

Limitations

- **Contextual Understanding** Co- storm may struggle with understanding the nuanced meaning and context of certain academic arguments.

- It may not always provide suggestions that are appropriate for specific fields or advanced topics.

- **Limited Customization**: CO-STORM AI operates based on pre-programmed algorithms and templates, which may not always align with the specific preferences or requirements of individual users. The content may not reflect the African context.

Co-STORM-AI

Risks

- **Concerns surrounding data privacy**, algorithmic bias, and the potential for over-reliance on technology raise ethical questions about the use of AI in educational contexts.

- **Over-Reliance on Technology**: One potential disadvantage is that over-reliance on AI could result in a decline in critical thinking and independent writing skills.

- **Privacy and Data Security**: Since CO-STORM AI works by analyzing large amounts of academic data, users may have concerns about the privacy of their research.

- **Potential for Inaccurate Recommendations**: While CO-STORM AI is trained on large datasets of academic content, there is always the risk of incorrect or outdated information being suggested.

- May hinder the development of expected STEM outcomes

CO-STORM-AI

Mitigations

- The user must interact with the content

- Address issues on data privacy through AI policy

- To avoid overreliance- use the AI content to generate original content

- Integrate AI with traditional teaching practices

- Users should acknowledge the use of AI tools

- Africanise the content

- How do we remain creative and continue to enhance critical thinking?- Researchers should interact with the content and own it.

CONCLUSION: Further Research

- Do AI tools help or hinder the in attainment of expected learning outcomes that is, Critical thinking. Creativity , Collaboration and Innovation?

- In my opinion, if used appropriately, they are of great help in developing STEM learning outcomes.

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