Scholarly Research Journal for Interdisciplinary Studies
Online ISSN 2278-8808, SJIF 2026 = 8.727
https://www.srjis.com/issues_data/304
Peer Reviewed & Refereed Journal, SEPT-OCT 2026, Vol- 15/97

USING ARTIFICIAL INTELLIGENCE AS A SCAFFOLDING TOOL TO PROTECT HUMAN CREATIVITY

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Paper Received On: 1 OCT 2026
Peer Reviewed On: 16 OCT 2026
Published On: 01 NOV 2026

Abstract

The rapid development of generative artificial intelligence (AI) has transformed the ways in which individuals generate ideas, solve problems, produce knowledge, and engage in creative activities. AI applications offer opportunities to stimulate imagination, overcome creative blocks, support intellectual exploration, and facilitate personalised learning. However, their increasing use also raises concerns about intellectual dependency, cognitive offloading, algorithmic homogenisation, diminished originality, and the possible erosion of human creative agency. This review examines how AI can be conceptualised and employed as a scaffolding tool that strengthens rather than substitutes for human creativity. Drawing upon educational scaffolding, constructivist perspectives, human-centred AI principles, and emerging empirical research, the article develops a conceptual understanding of responsible human–AI collaboration. It distinguishes between AI-assisted creativity, in which technology expands an individual's creative possibilities, and AI-dependent production, in which human judgement and original thinking are displaced by machine-generated outputs. Five interrelated dimensions of creativity-preserving AI use are identified: human agency, cognitive engagement, creative diversity, reflective evaluation, and gradual independence. Building on these dimensions, the article proposes the Human-Centred Creative Scaffolding Framework (HCCSF), comprising six stages: independent ideation, purposeful AI engagement, critical interrogation, selective adaptation and reconstruction, human authorship, and independent reflection. The article discusses implications for teachers, teacher educators, researchers, and educational institutions, particularly concerning academic integrity and responsible AI adoption. It argues that the educational value of AI should be assessed not merely through the quality or speed of immediate outputs but also through its contribution to independent creative competence. The article concludes that AI should remain a supportive resource while human beings retain authorship, judgement, responsibility, and creative direction.

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Keywords: *Artificial intelligence; human creativity; generative AI; scaffolding; creative agency; human–AI collaboration; critical thinking; educational technology; academic integrity; teacher education.*

1. Introduction

Creativity is a fundamental human capacity through which individuals interpret experiences, generate original ideas, construct knowledge, and develop meaningful responses to complex situations. It contributes to scientific discovery, artistic expression, educational innovation, and social transformation. In education, creativity extends beyond acquiring and reproducing information. It involves questioning assumptions, making connections, interpreting evidence, exploring alternatives, and constructing independent understanding.

The emergence of generative artificial intelligence (AI) has introduced new possibilities for supporting these processes. Contemporary AI systems can generate text, suggest research questions, develop examples, propose alternative explanations, assist with visual design, and facilitate the exploration of unfamiliar concepts. Consequently, AI is increasingly being considered not only as a productivity technology but also as a potential resource for learning and creative work.

Nevertheless, machine-generated ideas create an important educational dilemma. A tool that helps an individual overcome a creative difficulty may also encourage that individual to avoid the cognitive effort through which creativity develops. An AI-generated paragraph may provide a useful starting point for academic writing, yet accepting it without examination may reduce opportunities for independent interpretation, argument construction, and scholarly judgement. The central issue is therefore not simply whether AI can produce creative outputs, but whether it can help people become more capable, independent, and reflective creators.

Doshi and Hauser (2024) illustrate this complexity through their experimental study of short-story writing. They found that access to generative AI ideas improved the average assessed creativity and writing quality of individual stories, particularly among less creative participants. However, AI-assisted stories were also more similar to one another than stories produced without AI assistance. This finding highlights a tension between improved individual performance and the preservation of collective creative diversity.

The educational concept of scaffolding offers a useful perspective for addressing this challenge. Wood, Bruner, and Ross (1976) described how instructional support enables learners to undertake tasks that would otherwise be difficult for them. Applied to AI-supported learning, scaffolding suggests that technology should provide assistance where necessary while preserving the learner's responsibility for thinking, deciding, and creating.

The present article advances the argument that AI should be treated as a scaffolding tool for human creativity rather than a substitute for human creative agency. Its purpose should be to extend intellectual possibilities, not remove the intellectual participation through which originality and expertise develop.

1.1 Rationale and Objectives

The rationale for this review rests on three considerations. First, creativity is a developmental capacity rather than merely a characteristic of a finished product. An original-looking essay or lesson plan does not necessarily demonstrate that its producer can generate and evaluate original ideas independently. Second, AI-supported creativity involves opportunities as well as risks, including overdependence, reduced diversity, and diminished learner agency. Third, educational institutions require practical principles for integrating AI into teaching, learning, and research. UNESCO's guidance on generative AI emphasises human-centred implementation and the development of responsible AI competencies (Miao & Holmes, 2023; Miao et al., 2024).

Accordingly, the article aims to:

1. Examine the relationship between human creativity and generative AI.
2. Explain the relevance of educational scaffolding to AI-supported creative activities.
3. Identify the benefits and risks of AI use in creative learning and academic research.
4. Distinguish creativity-enhancing assistance from creativity-displacing dependence.
5. Propose a human-centred framework for protecting creative agency.
6. Suggest practical strategies for educators, researchers, and institutions.
7. Identify directions for future empirical research.

The review is guided by the following questions: How can AI support creativity without replacing independent thought? What risks arise from excessive dependence on generative AI? How can scaffolding principles inform creativity-preserving practices? What responsibilities should users and institutions assume? How can the development of independent creative competence be evaluated?

2. Conceptualizing Human Creativity in the Age of AI

2.1 Meaning and Nature of Creativity

Creativity is commonly understood as the capacity to produce ideas, processes, or products demonstrating both novelty and appropriateness (Runco & Jaeger, 2012). Novelty concerns the extent to which an idea differs meaningfully from existing possibilities, whereas appropriateness refers to its relevance, usefulness, coherence, or value within a particular context. An idea may be unusual but impractical, or useful but insufficiently original. Creative competence involves negotiating these dimensions according to the demands of a task.

Human creativity is multidimensional. It involves imagination, divergent thinking, problem identification, knowledge integration, emotional expression, critical judgement, experimentation, and revision. Creative individuals do not simply generate numerous possibilities; they evaluate alternatives, recognise limitations, and develop selected ideas into meaningful outcomes.

In education, creativity can be demonstrated when learners propose alternative explanations, design original teaching materials, interpret historical events from different perspectives, construct research questions, or develop solutions to authentic problems. These activities depend upon knowledge, personal experience, contextual understanding, curiosity, and evaluative judgement.

AI can contribute to some of these processes, but generated content should not automatically be regarded as evidence of the user's creative development. A response may appear novel without being unprecedented, while fluent explanations may conceal inaccuracies or conceptual gaps.

2.2 Human Creativity and Machine-Generated Content

Generative AI systems produce outputs by modelling patterns in data and generating responses based on learned relationships, system design, and user instructions. Their outputs can be sophisticated and useful for creative exploration. However, machine-generated content and human creative experience are not interchangeable.

Human creators work within personal, cultural, historical, emotional, and social contexts. Memories, relationships, embodied experiences, ethical commitments, and deliberate intentions influence what individuals choose to express and why they consider an expression meaningful. AI can help articulate an experience or explore a cultural theme, but the human user remains responsible for determining whether the resulting expression accurately reflects the intended meaning and respects its context.

The distinction is not that human-produced work is automatically original or that AI-assisted work is necessarily uncreative. It concerns agency, judgement, purpose, and the processes through which an outcome is developed. A human-centred approach therefore asks not only what has been produced, but also who made the important decisions, how alternatives were evaluated, and what the individual learned.

2.3 Individual and Collective Creative Diversity

Creativity has both individual and collective dimensions. AI may help an individual produce a stronger idea or communicate it more effectively. At the collective level, however, creativity also depends on diverse approaches, perspectives, styles, and interpretations.

If large numbers of people rely on similar systems and accept similar suggestions, their outputs may become increasingly alike. The findings of Doshi and Hauser (2024) demonstrate that improvements in individual creative writing outcomes can coexist with greater similarity among outputs. This suggests that creativity-preserving AI use must protect both individual capability and collective diversity. Users should develop initial ideas independently, seek contrasting perspectives, question default suggestions, and explore alternatives that reflect their own intellectual and cultural contexts.

3. Theoretical Foundations of AI as a Scaffolding Tool

3.1 Educational Scaffolding and Constructivist Learning

Scaffolding refers to instructional support that enables learners to perform tasks beyond their current level of independent competence. Wood et al. (1976) examined how tutoring helps learners manage the demands of problem-solving. Effective scaffolding reduces unnecessary barriers, directs attention to relevant features, provides explanations, and supports progress without completing the task on behalf of the learner.

A crucial feature is the appropriate level of assistance. Too little support may prevent progress, whereas excessive assistance may restrict the development of independent competence. AI can provide prompts, examples, feedback, alternative explanations, and questions for reflection. Its

educational value depends on whether these capabilities facilitate engagement with the problem rather than eliminate the need to engage with it.

Constructivist perspectives similarly emphasise that learners actively construct understanding through interaction with experiences, ideas, and social environments. For example, a learner studying educational philosophy may ask AI to compare two philosophical positions or identify questions for discussion. The learner must then examine the suggestions, relate them to relevant literature, and develop an independent interpretation. AI thereby becomes a resource for knowledge construction rather than a producer of finished assignments.

3.2 Zone of Proximal Development

Vygotsky's (1978) perspective highlights the importance of assistance in tasks that learners cannot yet complete independently but can undertake with appropriate support. Applied cautiously to AI, this suggests that technology may help learners move from partial understanding towards more capable performance.

A novice researcher, for example, may understand a general educational problem but struggle to formulate a focused research question. AI can provide examples of narrowing a topic or considering alternative research designs. Nevertheless, the researcher must determine whether the selected question is meaningful, feasible, ethically appropriate, and supported by relevant literature.

The developmental objective is not merely completion of the current task. It is the acquisition of competence needed to perform similar tasks with less assistance in the future.

3.3 Human Agency and Cognitive Offloading

Human agency refers to the capacity to make choices, exercise judgement, pursue purposes, and take responsibility for actions. In creative work, it includes identifying worthwhile problems, choosing ideas, determining meaning, and accepting responsibility for the final product. UNESCO's human-centred guidance emphasises that AI should be implemented in ways that protect human purposes and responsibilities (Miao & Holmes, 2023; Miao et al., 2024).

Cognitive offloading occurs when individuals use external resources to reduce the mental effort required for a task. It is not inherently harmful: reference books, calculators, and digital tools can reduce unnecessary demands on memory and attention. The important question is which activities are supported and which are displaced.

Using AI to organise research notes may allow a researcher to focus on interpretation. Asking it to identify weaknesses in an independently developed argument may strengthen critical judgement. Conversely, repeatedly outsourcing argument generation, interpretation of evidence, and evaluation of conclusions may reduce opportunities to practise those skills.

A creativity-preserving approach therefore encourages selective cognitive offloading. Routine operations may be delegated where appropriate, but core intellectual activities should remain visible and actively performed by the learner.

4. Potential of AI to Enhance Human Creativity

AI offers several possibilities for supporting creative work when its use is purposeful and critically guided.

- Overcoming
- creative blocks:
- Supporting divergent thinking:
- Developing creative confidence:
- Personalised learning:
- Interdisciplinary connections
- Improving revision:

5. Risks of AI Dependence for Human Creativity

- Replacement of Independent Thinking
- Algorithmic Homogenization and Premature Convergence
- False Confidence and Uncritical Acceptance
- Authorship and Intellectual Ownership
- Reduced Tolerance for Uncertainty and Contextual Limitations

6. AI as a Scaffold Rather Than a Substitute: Critical Synthesis

The consequences of AI use depend substantially on how human–AI interaction is organised. Requesting feedback on an independently developed argument differs from asking AI to produce an entire argument that is accepted without examination. The following principles distinguish supportive assistance from intellectual substitution.

1. **Assistance versus substitution:** AI assistance supports a person while preserving involvement in central intellectual decisions. Substitution occurs when the system performs the thinking or decision-making that the person is expected to develop or demonstrate. Whether a particular use is appropriate depends on the learning objectives and assessment rules.
2. **Product quality versus developmental value:** Evaluation should consider not only the clarity, accuracy, or originality of the final output but also whether the user generated ideas, compared alternatives, questioned suggestions, and acquired transferable skills.
3. **Graduated assistance:** The level of support should respond to the learner's competence and gradually decrease as independence develops. A novice may need structured questions and examples, while an experienced learner may require only critical feedback.
4. **Creative friction:** Not every intellectual difficulty should be removed. Questioning ideas, confronting contradictions, comparing alternatives, and working through uncertainty are productive parts of creative development. AI should reduce unnecessary barriers without eliminating these experiences.
5. **Critical distance:** AI-generated content should be treated as a proposal rather than a final answer. Users must examine its accuracy, originality, relevance, assumptions, and limitations, and remain willing to reject unsuitable suggestions.
6. **Human accountability:** Learners, researchers, teachers, and institutions retain responsibility for decisions made using AI. This includes accuracy, academic integrity, privacy, confidentiality, and compliance with relevant policies. Sensitive information

should not be submitted to external systems without appropriate authorisation and safeguards.

These principles provide the foundation for the proposed Human-Centred Creative Scaffolding Framework.

7. The Human-Centred Creative Scaffolding Framework (HCCSF)

7.1 Rationale and Structure

The review proposes the Human-Centred Creative Scaffolding Framework (HCCSF) to integrate creative exploration, critical thinking, human agency, and independent learning. It is a conceptual framework developed through the synthesis of scaffolding theory, human-centred AI principles, and research on generative AI and creative performance. It is proposed for future application and empirical testing; it is not an empirically validated instructional model.

Its central proposition is that AI should provide temporary assistance while the human creator retains responsibility for identifying the problem, evaluating alternatives, making decisions, and constructing the final outcome. The framework consists of six interconnected stages.

7.2 Six Stages of the HCCSF

Stage I: Independent Ideation

Stage II: Purposeful AI Engagement

Stage III: Critical Interrogation

Stage IV: Selective Adaptation and Reconstruction

Stage V: Human Authorship and Creative Production

Stage VI: Independent Reflection and Gradual Withdrawal

7.3 Summary of the Framework

Stage	Principal activity	Role of AI	Intended outcome
I. Independent ideation	• Generate initial ideas and questions	➢ Not yet introduced	✓ Independent intellectual engagement
II. Purposeful engagement	• Seek targeted assistance	➢ Provide prompts, alternatives, or feedback	✓ Expanded creative possibilities
III. Critical interrogation	• Examine suggestions and assumptions	➢ Supply material for evaluation	✓ Critical AI literacy
IV. Selective reconstruction	• Adapt, combine, or reject suggestions	➢ Offer provisional resources	✓ Originality and contextual relevance
V. Human authorship	• Develop the final work	➢ Provide permitted supplementary support	✓ Meaningful human-centred production
VI. Reflection and withdrawal	• Evaluate learning and attempt independent work	➢ Gradually reduce assistance	✓ Greater creative independence

Figure 1. Human-Centred Creative Scaffolding Framework

Independent ideation → Purposeful AI engagement → Critical interrogation → Selective adaptation and reconstruction → Human authorship → Independent reflection and gradual withdrawal.

The stages are presented sequentially for instructional clarity, but creative work may involve movement between them. Reflection may generate new questions, critical evaluation may require further assistance, and reconstruction may reveal the need for additional evidence. The framework is therefore interactive rather than rigidly linear.

7.4 Five Guiding Principles

The six stages are supported by five principles:

1. **Human agency:** People retain control over creative goals, significant decisions, and the final direction of their work.
2. **Cognitive engagement:** AI supports the thinking required by the task rather than eliminating opportunities to develop competence.
3. **Creative diversity:** Users explore contrasting ideas and preserve individual and cultural variation.
4. **Reflective evaluation:** Generated content is examined for accuracy, relevance, originality, and limitations.
5. **Gradual independence:** Assistance is adjusted to learners' needs and reduced as competence develops.

Together, these principles provide a basis for designing and evaluating creativity-preserving AI-supported activities.

8. Educational Applications of Creativity-Preserving AI

8.1 School Education

AI can support brainstorming, problem-solving, project work, storytelling, scientific investigation, and interdisciplinary learning. Students studying environmental conservation, for example, may first identify local environmental problems independently, use AI to explore possible causes and solutions, compare suggestions with community observations, and develop a project based on verified evidence. Teachers should guide questioning and ask students to explain which suggestions they accepted, rejected, or modified.

8.2 Teacher Education

Teacher education is an important context because prospective teachers must learn to evaluate the pedagogical value of instructional resources. AI may assist with lesson planning, assessment questions, classroom scenarios, and alternative explanations. However, professional competence requires understanding the curriculum, recognising learner needs, selecting appropriate methods, anticipating misconceptions, and evaluating learning outcomes.

Student teachers may design a lesson independently, consult AI for alternative approaches, compare the suggestions with pedagogical principles, and submit a revised lesson with a rationale explaining their decisions. Teacher educators should model responsible AI use, source verification, and the preservation of independent student thinking.

8.3 Higher Education and Research

AI may assist with preliminary brainstorming, organisation of notes, language refinement, and identifying questions for investigation. However, researchers remain responsible for establishing the scholarly basis of their arguments. They should verify references through reliable databases or publisher records, consult original publications, and ensure that sources support the claims attributed to them.

AI-generated summaries should not replace engagement with important primary sources. Research questions suggested by AI must be assessed for originality, feasibility, ethical acceptability, and relevance. Authors should follow the target journal's current requirements concerning AI assistance, disclosure, authorship, and confidentiality.

8.4 Creative Writing and Artistic Activities

AI can help writers explore narrative structures, identify inconsistencies, or experiment with different forms of expression. Visual tools may assist artists in exploring composition and preliminary concepts. However, artistic creativity also involves intention, interpretation, cultural meaning, emotional expression, and the development of a distinctive voice.

A suitable activity might require students to create an initial sketch or story independently, explore two contrasting AI-generated alternatives, and then develop a final version reflecting their own artistic decisions. Assessment should consider both the product and the creative process.

8.5 Research Methodology and Conceptual Development

AI can suggest alternative conceptual frameworks, possible variables, and methodological options. A researcher studying academic procrastination and academic resilience, for example, may use AI to explore possible theoretical relationships between the constructs. These suggestions must be examined through relevant literature and methodological reasoning.

AI may also assist in refining questionnaire items or suggesting dimensions of a construct. Such assistance does not replace systematic instrument development, expert review, pilot testing, reliability assessment, validity evidence, or ethical approval where required. Researchers must retain responsibility for methodological rigour.

8.6 Assessment and Evaluation

If assessment rewards only final products, students may have little incentive to demonstrate independent reasoning. More comprehensive assessment can include preliminary ideas, drafts, reflections, oral explanations, source verification, and independent follow-up tasks.

An assignment may require an initial conceptual map, an account of permitted AI assistance, a revised argument, and a reflection on decisions made during revision. Assessment should remain proportionate to the task and aligned with the competence being assessed. Independent unaided performance and AI literacy are different objectives and may require different assessment arrangements.

9. Ethical Considerations and Institutional Responsibilities

Responsible AI use requires clarity about academic integrity, privacy, inclusion, and institutional accountability.

Academic integrity and disclosure: Institutions should distinguish acceptable support, such as permitted feedback or language assistance, from prohibited substitution for independently assessed work. Students and researchers should follow task-specific rules and accurately disclose AI assistance where required. Disclosure alone does not guarantee integrity if the use still violates assessment requirements.

Privacy and confidentiality: AI use may involve personal information, student records, unpublished manuscripts, research data, and institutional documents. Such information should not be entered into external systems without appropriate authorisation and safeguards. Institutions should provide clear guidance on acceptable tools and data-protection responsibilities.

Bias, inclusion, and accessibility: AI systems may reproduce stereotypes, overlook cultural perspectives, or fail to address particular learner needs. At the same time, they may improve accessibility through alternative explanations and language support. These benefits must be considered alongside unequal access to devices, connectivity, and suitable technological resources.

Institutional policy and teacher preparation: Policies should avoid both unrestricted acceptance of AI-generated work and blanket prohibitions that prevent meaningful learning. They should specify permitted uses, disclosure requirements, privacy safeguards, and assessment expectations. Teacher preparation should include AI literacy, critical evaluation, source verification, ethical decision-making, and the design of activities that preserve student agency.

10. Proposed Evaluation Framework for Creativity-Preserving AI Use

The HCCSF may be evaluated through process-based and outcome-based indicators. The following dimensions are proposed for future research and educational practice. They do not constitute a validated measurement instrument or established psychometric scales.

Dimension	Suggested indicators	Possible assessment methods
Independent ideation	• Quality of independently generated ideas and problem identification	➢ Initial drafts, concept maps
Creative flexibility	• Ability to develop different approaches	➢ Alternative solutions, divergent-thinking tasks
Originality	• Novelty and distinctiveness	➢ Expert ratings, comparative analysis
Critical evaluation	• Identification of errors, assumptions, and weaknesses	➢ Critique tasks, annotated drafts
Human agency	• Justification of acceptance, rejection, and modification	➢ Reflective reports, decision rationales
Factual reliability	• Accuracy and appropriate source verification	➢ Reference audits, evidence checks
Contextual relevance	• Suitability for the intended audience and setting	➢ Expert and contextual review
Independent competence	• Ability to complete comparable tasks with reduced assistance	➢ Transfer tasks, delayed assessments
Creative diversity	• Variation among group outputs	➢ Expert comparisons, appropriate computational measures

Ethical responsibility	• Compliance with disclosure, privacy, and integrity requirements	➢ Process documentation, policy-based review

Evaluation should consider both immediate performance and delayed transfer. A learner may produce a better output during an assisted activity without demonstrating improved independent performance later. Future research should compare immediate results with delayed assessments to determine whether AI-supported scaffolding contributes to durable competence.

Evaluation should also distinguish individual creativity from collective diversity. A tool may improve the quality of each participant's work while reducing variation across the group. Both dimensions are important, although their relative significance depends on the task. Originality in scientific problem-solving may require different criteria from originality in poetry or classroom design. No single measure can fully capture the complexity of human creativity.

11. Limitations of the Review

This article presents a conceptual review and proposes a framework rather than reporting a new empirical investigation. It does not establish the effectiveness of the HCCSF through experimental or longitudinal evidence. The discussion draws upon selected theoretical and research contributions relevant to scaffolding, human-centred AI, and creativity; it is not an exhaustive systematic review. A formal systematic review would require a documented search strategy, explicit inclusion and exclusion criteria, reproducible screening, and structured assessment of included studies.

Furthermore, the effects of AI may vary across systems, versions, tasks, populations, and contexts. Findings from creative writing experiments cannot automatically be generalised to scientific research, visual arts, classroom instruction, or other forms of creative work. The proposed evaluation indicators also require operational definition and validation before they can be used as a standardised instrument. These limitations identify opportunities for further research rather than invalidating the framework's conceptual contribution.

12. Conclusion

Artificial intelligence has created new opportunities for exploring ideas, developing alternative perspectives, overcoming creative barriers, and improving intellectual work. However, the availability of generated content also raises questions about independent thinking, originality, creative diversity, authorship, and the development of lasting competence.

This review argues that the central challenge is not to choose between human creativity and AI, but to determine how AI can support creativity without displacing the human capacities that give creative work its developmental and intellectual value. Educational scaffolding provides a useful foundation. Technological assistance should be purposeful, critical, contextual, and gradually reduced as competence develops.

The proposed Human-Centred Creative Scaffolding Framework translates this principle into six stages: independent ideation, purposeful AI engagement, critical interrogation, selective adaptation and reconstruction, human authorship, and independent reflection. Its five guiding principles—human agency, cognitive engagement, creative diversity, reflective evaluation, and gradual independence—provide a basis for responsible AI integration in education and research.

Creativity should be evaluated at both individual and collective levels. AI may improve the immediate quality of an individual's work, but a comprehensive assessment must also consider whether the individual becomes more capable of creating independently and whether diversity of creative expression is preserved.

For teachers, this means using AI to stimulate questioning rather than simply provide answers. For researchers, it means treating AI-generated suggestions as provisional resources rather than substitutes for scholarly judgement. For institutions, it means aligning policies and assessment practices with the development of independent competence.

The ultimate objective is not to produce individuals who generate more content with AI, but individuals who think more critically, imagine more widely, judge more responsibly, and create more independently—with AI when appropriate and without it when necessary.

AI should serve as a scaffold for human imagination, not a substitute for human thought. Its greatest educational contribution will be realised when it helps people become more capable creators rather than more efficient dependants on generated content.

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