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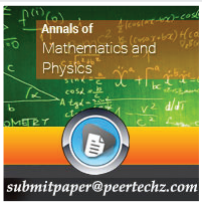

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Research Article

The dark side of screens: Exploring impairment with the iRAT framework

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Abstract

This paper introduces the iRAT model, an extension of the existing RAT framework, to comprehensively evaluate the integration of digital media in educational settings. While the traditional RAT framework focuses on Replacement, Amplification, and Transformation, the iRAT model includes a fourth category: Impairment. This new category addresses the potential negative impacts of digital media use, such as unnecessary app usage, distractions from learning objectives, lack of pedagogical integration, and resource wastage. The study employs a mixed-methods approach, including participatory observation, lesson plan evaluation, expert think-aloud protocols, and AI-driven scenario identification, to validate the iRAT model. Findings highlight the importance of considering both positive and negative aspects of digital media integration, suggesting that future research should adopt the iRAT framework for a balanced evaluation. This study closes a significant research gap and challenges the overly optimistic view of digital media in education, advocating for a more critical perspective.

Introduction

Digital media have become an integral part of the modern educational landscape. It is crucial for educators to utilize these digital tools thoughtfully and effectively to enhance the learning experience.

In evaluating the integration of digital media in education, various models have been proposed, such as the SAMR model (Substitution, Augmentation, Modification, and Redefinition) and the RAT framework (Replacement, Amplification, and Transformation). These models provide valuable frameworks for assessing how technology is incorporated into the classroom and the extent to which it transforms teaching and learning processes.

The SAMR model, developed by Dr. Ruben Puentedura [1], categorizes the use of technology into four levels. At the Substitution level, technology acts as a direct substitute for traditional tools, with no functional change. Augmentation involves technology that acts as a substitute with some functional improvements. Modification allows for significant task redesign, while Redefinition enables the creation of new tasks that were previously inconceivable.

Similarly, the RAT framework, proposed by Hughes, et al. [2], evaluates technology use through three lenses. Replacement describes technology that replaces traditional methods without changing the instructional strategy. Amplification involves technology that enhances existing practices, making them more efficient or effective. Transformation refers to technology that fundamentally changes the way instruction is delivered and learning occurs.

While these models highlight the positive aspects of digital media integration, focusing primarily on the potential enhancements and transformative possibilities, it is essential to acknowledge that the use of digital tools in education can also lead to less desirable outcomes. There are instances where the application of technology may detract from the learning experience, hinder student engagement, or lead to superficial rather than meaningful learning.

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Therefore, to create a more balanced evaluation framework, it is necessary to include a category that addresses these potential drawbacks. This additional category, which could be termed "Impairment," would encompass scenarios where the use of digital media negatively impacts the learning environment. Examples of such impairment include technology-induced distractions, over-reliance on digital tools leading to diminished critical thinking skills, and the digital divide exacerbating educational inequalities.

While models like SAMR and RAT offer valuable insights into the effective integration of digital media in education, they must be expanded to consider both the positive and negative impacts. Thus, by incorporating a category that addresses the potential adverse effects, educators and researchers can develop a more comprehensive understanding of how digital media influences the educational process. This balanced approach will ensure that the integration of digital tools supports meaningful and equitable learning outcomes for all students. We call this new model the iRAT framework. The innovative edge over existing models is, that with this new model, one can also rate the worsification of teaching by the usage of digital media.

Theoretical background

The SAMR model, developed by Puentedura [1], categorizes the use of technology into four levels:

- **Substitution:** At this level, technology acts as a direct substitute for traditional tools, with no functional change. For example, using a word processor instead of pen and paper to write an essay. The task remains the same, but the medium has changed. This level does not typically enhance learning outcomes significantly, but it can make tasks more convenient or accessible.

- **Augmentation:** Technology still substitutes for traditional tools but with some functional improvements. For instance, using a word processor that includes spell-checking and grammar suggestions. While the core task of writing an essay remains unchanged, the additional features provided by the technology can improve the quality of the work and make the process more efficient.

- **Modification:** At this stage, technology allows for significant task redesign. An example would be using collaborative tools like Google Docs, where multiple students can work on the same document simultaneously, providing real-time feedback and edits. This changes the nature of the task, fostering collaboration and communication skills, and enhancing the learning experience.

- **Redefinition:** This highest level of the SAMR model involves using technology to create new tasks that were previously inconceivable. For example, students might create a multimedia project that includes video, audio, and interactive elements to demonstrate their understanding of a topic. This level transforms learning by leveraging technology to enable new types of activities and learning experiences that transcend traditional methods.

The SAMR model offers several significant advantages for classroom instruction. One of the primary benefits is that it facilitates the integration of technology into the learning process, which can lead to an enhancement of students' critical thinking skills [3]. By using technology at higher levels of the SAMR model, such as Modification and Redefinition, students are encouraged to engage in more complex and innovative tasks that require critical analysis, problem-solving, and creativity.

Moreover, the SAMR model provides a comprehensive framework for evaluating learning activities, particularly in the context of mobile learning. This framework helps educators assess how effectively technology is being used to transform learning experiences. For instance, in mobile learning scenarios, teachers can use the SAMR model to design activities that not only substitute traditional tasks but also augment, modify, and redefine them to take full advantage of mobile technology's capabilities [4].

Research has also demonstrated that the SAMR model can significantly improve student performance [5]. This improvement is particularly evident at the Modification and Redefinition levels, where technology enables substantial changes to the learning tasks and allows students to engage in activities that were previously inconceivable. For example,

Table 1: Summarizing of the iRAT framework.

Figure 1: Technology-enhanced rat, image AI generated

Transformation	Technology allows for new tasks that were previously inconceivable, fundamentally changing the learning experience.
Amplification	Technology enhances existing tasks, making them more efficient or effective without fundamentally altering them.
Replacement	Technology acts as a direct substitute for traditional methods without changing the task's nature.
Impairment	Recognizes potential negative impacts of technology integration. Subcategories include: - Unnecessary Use of Apps and Software - Distraction from the Primary Learning Objective - Lack of Pedagogical Integration - Waste of Resources

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students might collaborate on global projects, create interactive digital content, or use advanced software tools to analyze complex data sets, all of which can lead to deeper understanding and retention of the material.

Additionally, a case study indicated that 84% of participants preferred online presentations over traditional classroom presentations [6]. This preference suggests that the SAMR model's approach to technology integration can be especially beneficial in online learning environments. Online presentations, supported by tools and platforms that enhance interactivity and accessibility, can make learning more engaging and convenient for students, thus improving their overall learning experience.

In summary, the SAMR model provides a structured and effective method for integrating technology into classroom instruction. By guiding educators through a progression from basic substitution to complete redefinition of tasks, the model ensures that technology is used not just for its own sake, but in ways that genuinely enhance and transform the learning process. This structured approach can lead to significant improvements in student engagement, critical thinking, and academic performance, making the SAMR model a valuable tool for modern educators aiming to leverage technology in their teaching.

While the SAMR model offers a valuable framework for integrating technology into education, it can sometimes be challenging to distinguish between the middle stages of Augmentation and Modification in practice. This ambiguity can make it difficult for educators to accurately assess the extent to which technology is transforming the learning process. In this context, the RAT framework (Replacement, Amplification, and Transformation) can be a simpler and more straightforward tool for evaluation.

The RAT framework, proposed by Hughes, et al. [2], provides a clear and concise method for evaluating the integration of technology in educational settings. It focuses on three key stages:

1. **Replacement**: At this level, technology directly substitutes traditional methods without changing the fundamental nature of the task. For example, using a digital document instead of a paper one to complete an assignment. While this substitution can offer benefits such as increased convenience and accessibility, it does not fundamentally alter the instructional strategy or learning outcomes.

2. **Amplification**: The Amplification stage involves using technology to enhance existing educational practices, making them more efficient or effective. For instance, using a spreadsheet program to automatically calculate and graph data collected in a science experiment. This use of technology amplifies the learning experience by streamlining processes and providing additional insights, but it does not fundamentally change the nature of the task itself.

3. **Transformation**: In the Transformation stage, technology enables new ways of learning and teaching that were not possible before. This level represents a fundamental change in the instructional approach. Examples include using virtual reality to explore historical sites or conducting live video collaborations with students from other countries. These activities transform the learning experience by allowing students to engage with content in innovative and immersive ways.

The simplicity of the RAT framework lies in its straightforward categorization of technology use. By focusing on whether technology replaces, amplifies, or transforms educational activities, educators can more easily assess and plan their integration strategies. This clarity can be particularly useful in ensuring that technology is used to genuinely enhance learning, rather than merely substituting traditional methods without adding significant value.

While the SAMR model provides a comprehensive approach to integrating technology in education, it is the RAT framework that offers a more straightforward alternative that can simplify the evaluation process. By distinguishing between Replacement, Amplification, and Transformation, educators can more easily identify and implement effective uses of technology in their teaching practices. This balanced approach ensures that technology integration supports meaningful and impactful learning experiences for students.

The RAT framework has evolved over time, reflecting the growing complexity of technology integration in education [7]. However, while frameworks like RAT offer valuable insights into the multifaceted nature of technology integration, it is essential to recognize that focusing solely on the positive aspects may overlook potential drawbacks. Therefore, to provide a more holistic perspective, we introduce the iRAT (Impairment Replacement Amplification Transformation) framework, which incorporates Impairment as an additional dimension. This framework aims to balance the assessment of both positive and negative impacts of technology integration in education, ensuring a comprehensive evaluation of its effectiveness.

In recent studies, several disadvantages of using digital media in educational settings have emerged, emphasizing the need for these aspects to be included in evaluation frameworks. These drawbacks highlight the necessity of a balanced approach to integrating technology in the classroom.

Current research has documented various negative effects of digital media usage in schools. For instance, studies have shown that digital media can cause concentration disruptions and addiction among students. This dependency not only hampers their ability to focus during class but also detrimentally impacts their overall academic performance [8].

Moreover, excessive use of social media platforms has been linked to cyberbullying and online harassment. These negative interactions often lead to psychological distress and

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decreased self-esteem among students, further affecting their mental well-being. The constant exposure to negative social comparisons on these platforms exacerbates these issues, making it crucial for educators and policymakers to address them [9].

Academic performance can also be negatively influenced by poor media literacy skills. When students lack the ability to critically evaluate the information they encounter online, they are more likely to be misled by incorrect or biased information. This misinformation can degrade the quality of their learning and understanding, ultimately affecting their academic success [10].

Additionally, health risks associated with digital media usage cannot be overlooked. Digital games, especially those with violent content, have been found to contribute to addiction, depression, and obesity among students. These health issues, coupled with the impact on academic performance, underscore the importance of mindful digital media consumption [11].

The COVID-19 pandemic has further highlighted these concerns, as increased screen time for online learning has posed significant health risks. Prolonged exposure to screens has been linked to various developmental issues in children, making it imperative for parents and educators to monitor and regulate screen time effectively [12].

These studies collectively emphasize the importance of integrating monitoring and management strategies for digital media usage within educational frameworks. By acknowledging and addressing these negative effects, educators can better harness the potential of digital media while mitigating its adverse impacts on students' academic performance and overall well-being.

Conceptualization

Based on previous experiences, experts in the field of educational research, including the authors of this paper, have deemed the original RAT framework as incomplete for evaluating the diverse scenarios of technology integration. Consequently, the framework has been expanded to include the category of "Impairment," which addresses potential deteriorations in the learning process. This additional category ensures a more comprehensive assessment by recognizing and accounting for the negative impacts that technology can have in educational settings.

The development of the iRAT model involved several key steps, which were crucial in ensuring its robustness and applicability. Firstly, a thorough literature review was conducted to identify existing gaps and limitations in current evaluation frameworks. This review highlighted the need for a more holistic approach that includes negative aspects of technology use.

Next, the authors engaged in a series of expert consultations and workshops, bringing together educators, researchers, and technologists to gather diverse perspectives and insights. These collaborative sessions were instrumental in defining the "Impairment" category and its subcategories, ensuring they were grounded in real-world educational challenges.

The "Impairment" category encompasses several subcategories, which include:

- **Unnecessary Use of Apps and Software**: This refers to instances where digital tools are used without adding meaningful value to the learning process, leading to wasted time and effort.
- **Distraction from the Primary Learning Objective**: Technology can sometimes divert students' attention away from the main educational goals, reducing the overall effectiveness of instruction.
- **Lack of pedagogical integration**: When technology is not seamlessly integrated into the teaching strategy, it can disrupt the flow of the lesson and hinder learning outcomes.
- **Waste of resources**: This includes the inefficient use of financial, time, and material resources on technology that does not significantly enhance the learning experience.

Following these consultations, a draft version of the iRAT model was developed and subjected to pilot testing in various educational settings. Feedback from these pilot tests was critical in refining the model, addressing any practical implementation issues, and ensuring its relevance and usability for educators.

These subcategories provide a structured way to identify and evaluate the potential drawbacks of technology use in education, ensuring that both positive and negative aspects are considered. The expanded framework, referred to as the iRAT (Integrated RAT) model, offers a balanced approach to assessing technology integration.

Below is a table summarizing the iRAT model Table 1, Figure 1:

This table provides a concise overview of the iRAT model, highlighting both the transformative potential of technology and the possible pitfalls that need to be addressed for successful integration.

Methods

To evaluate the suitability of the iRAT model for assessing scenarios of digital media use in classroom settings, the model was applied to various scenarios using a mixed-methods approach. This approach included several distinct methodologies to ensure a comprehensive assessment.

Participatory observation

One key method was participatory observation, which involved observing the use of digital media in real classroom settings. Researchers immersed themselves in the educational environment, participating in lessons alongside students and teachers. This method allowed for a detailed and nuanced

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understanding of how digital media was being integrated into daily teaching practices. Researchers recorded their observations, focusing on the effectiveness of the technology, student engagement, and any instances of impairment, such as distractions or resource wastage. These firsthand observations provided valuable insights into the practical application of the iRAT model and its ability to capture both the benefits and drawbacks of digital media use. The researchers were in all the classrooms where the teachers permitted observations. These were mainly secondary school lessons from the STEM subjects.

Evaluation of lesson plans

In addition to real-world observations, the model was also applied to evaluate lesson plans designed by pre-service teachers. These lesson plans were assessed to determine how well they integrated digital media and to identify any potential areas of impairment. This method involved a detailed analysis of the lesson plans to see if they met the criteria outlined in the iRAT model categories: Replacement, Amplification, Transformation, and Impairment. By analyzing these plans, researchers could gauge the preparedness of future educators to effectively integrate technology into their teaching and the common challenges they might face.

Think-aloud protocol with experts

To gather additional insights, the think-aloud protocol was employed with experts in the field of educational technology. In this method, experts were presented with potential classroom scenarios involving digital media and were asked to articulate their thought processes as they evaluated these scenarios. This approach allowed researchers to capture the experts' immediate reactions and reasoning, providing a deeper understanding of the strengths and limitations of the iRAT model. The think-aloud sessions were recorded and transcribed, and the data was analyzed to identify recurring themes and insights regarding the practical application of the model.

AI-driven scenario identification

Finally, an innovative method was utilized by involving artificial intelligence (AI) in the identification of possible digital media use scenarios. AI tools were queried to generate various scenarios of digital media integration in the classroom. These AI-generated scenarios were then evaluated using the iRAT model to determine their feasibility and effectiveness. This method not only provided a diverse range of potential use cases but also demonstrated the potential of AI in supporting educational research and planning.

By employing these diverse methodologies, the study ensured a robust and comprehensive evaluation of the iRAT model. Each method provided unique insights and highlighted different aspects of digital media integration, contributing to a well-rounded understanding of the model's applicability and effectiveness in real-world educational settings.

Categorization as impairment

To categorize examples under the Impairment category, we applied a rigorous evaluation process based on several criteria. Examples were included in the Impairment category if existing non-digital methods proved to be more effective. Additionally, we observed and noted behaviors among students that did not contribute to their learning success, such as playing games during instructional time. Instances where there were observable deteriorations in students' health, such as headaches, nausea, or epileptic seizures, were also classified under Impairment. Finally, expert opinions were considered, and examples were categorized as Impairment if experts explicitly identified them as detrimental or ineffective for educational purposes. This multi-faceted approach ensured a comprehensive assessment of the negative impacts of digital media use in educational settings.

Results

Existing literature, such as studies by Read [13] and Luckay & Marthinisen [14], provides numerous examples for the categories of Replacement, Amplification, and Transformation within the RAT framework. Therefore, this section focuses exclusively on the category of Impairment, which was introduced to address the potential negative impacts of technology integration in the classroom. The following examples illustrate various instances of impairment as observed and evaluated using the iRAT model.

Unnecessary use of apps and software

Example A: In some classrooms, teachers use apps designed to simulate scientific experiments that can be easily and inexpensively conducted in the classroom. For example, using an app to simulate optical experiments with water lenses, can be more effectively demonstrated with actual water and lenses. This unnecessary substitution removes the hands-on experience that is crucial for students' understanding of physical principles.

Example B: Complex software for data analysis is sometimes employed when simpler spreadsheet programs would suffice. For instance, using advanced statistical software to analyze basic data sets can overwhelm students with unnecessary features, shifting their focus from learning data analysis techniques to simply navigating the software.

Example C: Interactive whiteboards are often used for tasks that could be just as effectively accomplished with traditional chalkboards. For example, labeling diagrams on an interactive whiteboard offers no significant advantage over using chalk and a blackboard, yet it consumes more resources and can complicate simple tasks, making the process more cumbersome than necessary.

Example D: Some teachers film themselves writing on a tablet using a document camera and project it onto a screen, instead of directly connecting the tablet to the projector. This indirect method introduces unnecessary steps and potential technical issues, complicating what should be a straightforward process.

These examples demonstrate how the unnecessary use of apps and software can lead to inefficiencies and

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missed opportunities for more effective, hands-on learning experiences, illustrating the subcategory of unnecessary use of technology within the Impairment category.

Distraction from the primary learning objective

Example A: Multimedia presentations with numerous animations and sound effects can captivate students' attention, but often distract from the core content. For instance, a history lesson presented with excessive animations and sounds can lead students to focus more on the visual and auditory stimuli rather than the historical facts and context being taught.

Example B: Incorporating gamification elements that prioritize entertainment over educational value can lead to students being more engaged with the game mechanics than with the learning objectives. For example, a math app that turns solving equations into a game may emphasize winning points over understanding the mathematical concepts.

Example C: The use of social media platforms in the classroom can lead to unproductive activities. For example, encouraging students to discuss class topics on a platform like Facebook can easily result in them becoming distracted by unrelated content, reducing the time and focus on academic tasks.

Example D: Virtual reality (VR) headsets, while innovative, can sometimes cause physical discomfort, such as nausea or dizziness, among students. This discomfort can distract them from the learning experience and negatively impact their ability to focus on the educational content.

These examples highlight how certain uses of technology can divert students' attention away from the primary learning objectives, demonstrating the subcategory of distraction within the Impairment category.

Lack of pedagogical integration

Example A: Digital media are sometimes employed without a clear connection to the learning objectives or the sequence of the lesson. For instance, using an educational app without explaining its relevance to the lesson can leave students confused about its purpose.

Example B: Media are often used as "fillers" without any thoughtful integration into the curriculum. For example, showing a video unrelated to the current topic just to occupy time can waste valuable instructional time and fail to provide any meaningful educational benefit.

Example C: Students are sometimes left to navigate digital media tools without adequate guidance and support from teachers. For instance, assigning students to research using the internet without teaching them how to evaluate sources can lead to misinformation and confusion.

Example D: Over-reliance on digital media can replace valuable face-to-face interactions between students and teachers. For example, in some classrooms, students are required to wear VR headsets and experience the classroom as a virtual environment, which can detract from real-life social and interactive skills development.

Example E: The use of instructional videos with incorrect or misleading content for independent study can lead to confusion and the propagation of misinformation among students. Without proper vetting, these resources can do more harm than good.

These examples illustrate how digital media can fail to be effectively integrated into the pedagogical framework, demonstrating the subcategory of lack of pedagogical integration within the Impairment category.

Waste of resources

Example A: Schools often invest in expensive hardware and software that are not utilized to their full potential. For example, purchasing high-end tablets for every student, which then remain underused due to a lack of suitable apps or training, represents a significant waste of financial resources.

Example B: Subscriptions to online services that do not deliver the expected educational value can drain school budgets. For instance, subscribing to an online learning platform that is rarely used by teachers or students results in wasted funds that could be better spent on more effective tools.

Example C: The use of digital media can lead to increased energy consumption, especially when devices are not managed efficiently. For example, leaving tablets and computers on when not in use increases operational costs and has environmental implications.

Example D: Complicated organizational tools with multiple nested menus and no search functionality can hinder rather than help teachers and students. For instance, using an overly complex project management tool can result in more time spent navigating the interface than actually planning and executing lessons.

These examples show how the misuse or underuse of technology can lead to a significant waste of resources, illustrating the subcategory of resource waste within the Impairment category.

Discussion

The findings from our study demonstrate the robustness and applicability of the iRAT model in assessing the integration of digital media in educational settings. Through the lens of Impairment, our research fills a significant gap in the existing literature, which has predominantly focused on the positive aspects of technology integration as outlined in the traditional RAT framework.

Our study highlights several key insights

Robustness of the iRAT model: The examples provided illustrate how the iRAT model effectively captures the negative impacts of digital media use in the classroom. For instance, the unnecessary use of apps and software, as seen in the case of

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using complex data analysis tools when simpler spreadsheet programs would suffice, underscores the potential for over-complication and resource wastage. Similarly, the use of multimedia presentations with excessive animations and sound effects, which distract students from the primary learning objectives, exemplifies how technology can inadvertently hinder educational outcomes. These observations confirm the need for the Impairment category to ensure a comprehensive evaluation of digital media integration.

Addressing a major research gap: By incorporating the Impairment category, our study addresses a crucial research gap. Previous studies, such as those by Read [13] and Luckay & Marthinisen [14], have predominantly documented the benefits of digital media through the Replacement, Amplification, and Transformation categories. However, our research reveals that these perspectives are incomplete without considering the potential drawbacks. The examples of poor pedagogical integration and resource wastage demonstrate that without a balanced view, the efficacy of digital media in education could be overstated. Thus, our work provides a more nuanced understanding of the impacts of technology in the classroom.

Strength of the mixed-methods approach: The strength of our study lies in the innovative mixed-methods approach employed. The participatory observation allowed gaining firsthand insights into the real-world application of digital media, while the evaluation of lesson plans provided a practical assessment of future educators' readiness to integrate technology. The think-aloud protocol with experts offered valuable perspectives on the cognitive processes involved in evaluating digital media use, and the AI-driven scenario identification introduced a novel dimension to our research. This comprehensive approach ensured a well-rounded evaluation of the iRAT model, minimizing potential biases and weaknesses.

Implications for future research and practice: Given the clear evidence of Impairment in the use of digital media, our study advocates for the adoption of the iRAT model in future research and practice. The traditional RAT framework's focus on positive aspects alone is insufficient and potentially misleading. Our findings suggest that researchers and educators must critically examine both the benefits and drawbacks of technology integration. The examples of technology-induced distractions and unnecessary complexity underscore the need for a balanced approach that recognizes the potential for negative outcomes.

In conclusion, our study not only fills a significant research gap by introducing the Impairment category but also establishes a strong case for the iRAT model as a comprehensive framework for evaluating digital media use in education. The mixed-methods approach has demonstrated the model's robustness and practical relevance, providing a solid foundation for future research. It is imperative that the research community moves beyond the overly optimistic view of digital media encapsulated in the traditional RAT framework and adopts a more critical and balanced perspective as provided by the iRAT model. This shift will enable a more accurate assessment of technology's role in education, ensuring that its integration genuinely enhances learning outcomes without inadvertently causing harm.

Practical implications for educators and policymakers

The introduction of the iRAT Framework significantly enhances the traditional RAT Framework by adding a new category: Impairment. Positioned as a step below Replacement, Impairment identifies scenarios where the use of digital media leads to a degradation in the quality of education. This addition offers several practical implications for both educators and policymakers.

For educators

The iRAT Framework serves as a valuable tool for reflection and self-assessment among educators. By identifying instances where the integration of digital media results in negative outcomes, educators can make informed decisions to discontinue or modify such practices. This reflective practice encourages a more critical approach to technology use, ensuring that digital tools genuinely enhance learning rather than detract from it. Educators can use this framework to continuously evaluate and refine their teaching strategies, promoting a more effective and health-conscious learning environment.

For policymakers

Policymakers can leverage the iRAT Framework to make more informed decisions regarding the allocation of resources and investments in educational technology. By recognizing the potential for digital media to cause more harm than good in certain contexts, policymakers can reduce unnecessary expenditures on ineffective or detrimental technologies. The framework also provides a basis for implementing accountability measures. In cases where resources are wasted or misused, the framework can support the justification for sanctions or the reallocation of funds to more beneficial initiatives.

Additional implications

1. **Professional development**: The iRAT Framework can inform professional development programs for teachers, highlighting the importance of discerning beneficial uses of technology from those that impair learning. Training can focus on recognizing signs of impairment and adopting best practices for technology integration.

2. **Curriculum design**: Curriculum developers can use the iRAT Framework to create guidelines and standards that ensure digital media is used appropriately and effectively. This can lead to the development of curricula that maximize the benefits of technology while minimizing its risks.

3. **Parental involvement**: The framework can also be a valuable resource for parents, helping them understand the potential negative impacts of digital media on their

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children's education and health. Educators can work with parents to establish balanced screen time practices and healthy technology use habits at home.

4. **Research and evaluation**: Future research can utilize the iRAT Framework to further explore the impacts of digital media in education. By providing a structured approach to evaluate both positive and negative outcomes, the framework can guide more comprehensive studies and contribute to the body of knowledge in educational technology.

5. **Policy formulation**: The framework can assist in formulating policies that promote the responsible use of technology in schools. By setting clear standards and expectations, policymakers can ensure that technology serves as a tool for enhancement rather than a source of impairment.

In conclusion, the iRAT Framework not only extends the RAT Framework by incorporating a critical dimension of evaluation but also provides practical guidance for educators and policymakers. By recognizing and addressing the potential drawbacks of digital media, the framework fosters a more balanced and effective approach to technology integration in education.

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We would like to acknowledge that while we used various AI tools and services to assist in formulating and articulating our ideas, the final work was thoroughly reviewed and edited by the authors. This step was taken to ensure accuracy and guard against any potential bias that may have been introduced by the AI tools.

The authors take full responsibility for the content of this publication. Every effort has been made to ensure the integrity and validity of the findings and discussions presented in this paper.

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References

1. Puentedura RR. Transformation, technology, and education in the state of Maine. 2006 Januar 1. http://www.hippasus.com/rrpweblog/archives/2006_11.html

2. Hughes J, Thomas R, Scharber C. Assessing technology integration: The RAT–replacement, amplification, and transformation-framework. Society for information technology & teacher education international conference. 2006:1616-1620.

3. Setiyawati S, Basori B, Efendi A. Substitution, Augmentation, Modification and Redefinition (SAMR) Model to Improve Student's Critical Thinking Ability. IJIE (Indonesian Journal of Informatics Education). 2023;7(1):8. https://doi.org/10.20961/ijie.v7i1.60356

4. Sompakdee P, Chompurach W, Thanamaimas W, Kotmungkun S. Applying the Matrix Model in an English for Presentation Online Class during COVID-19 Pandemic: A Case Study of an Undergraduate Class in Thailand. English Language Teaching. 2021;14(9):12. https://doi.org/10.5539/elt.v14n9p12

5. Nair RS, Chuan TC. Integrating Technology that Uses Modified SAMR Model as a Pedagogical Framework in Evaluating Learning Performance of Undergraduates. The Educational Review, USA. 2021;5(10):373-384. https://doi.org/10.26855/er.2021.10.001

6. Romrell D, Kidder LC, Wood E. The SAMR Model as a Framework for evaluating mLearning. Online Learning. 2014;18(2). https://doi.org/10.24059/olj.v18i2.435

7. Kimmons R, Graham CR, West RE. The PICRAT Model for Technology Integration in Teacher Preparation. Contemporary Issues in Technology and Teacher Education. 2020;20:176-198.

8. Hidayati M. Utilization of Digital Media Among Communication Science Study Program Students, Faculty of Social and Political Sciences, Malikussaleh University. Telangke J Telangke Commun Sci. 2024;5(1):47-58. https://doi.org/10.55542/jiksohum.v5i1.761

9. Jha RR. Impact of social media on students. Int J Sci Res Eng Manag. 2024;08(04):1-5. https://doi.org/10.55041/IJSREM32045

10. Sangaji AC, Pribadi IA. Effect of Digital Literacy and Educational Technology on School Quality: Case Study of The Tiara Bangsa School. Jurnal Penelitian Pendidikan IPA. 2023;9(2):721-728. https://doi.org/10.29303/jppipa.v9i2.2827

11. Bösche W, Kattner F. Fear of (Serious) Digital Games and Game-Based Learning?: Causes, Consequences and a Possible Countermeasure. Int J Game-Based Learn. 2011;1(3):1-15. https://doi.org/10.4018/ijgbl.2011070101

12. Yudianita Kesuma. Effect of Screentime during School From Home. Conf Med Sci Dies Natalis Fac Med Univ Sriwijaya. 2020;2(1):101-106. https://doi.org/10.32539/dies.v2i1.46

13. Read M. RAT. EdTechnica. 2022. https://doi.org/10.59668/371.7485

14. Luckay M, Marthinisen P. Innovations in technology education toward technological literacy – A study of two high schools in South Africa. Australas J Technol Educ. 2023;9. https://doi.org/10.15663/ajte.v9.i0.108

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