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"Navigating the Complexities of CAD Assessment: Challenges and Solutions for High School Students in Harare Schools."

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Abstract: This study provides an in-depth examination of the multifaceted challenges teachers encounter when assessing CAD designs in Harare schools. The research focuses on the diversity of student abilities and learning approaches, highlighting the complexities involved in creating fair and equitable assessments. It explores how educators can balance the need to evaluate both advanced and novice students effectively, ensuring that all students receive a fair assessment of their skills. A significant focus is placed on the inherent subjectivity involved in assessing creative CAD projects. The study investigates the tension between fostering student innovation and adhering to standardized evaluation criteria. This balance is crucial in maintaining both the integrity of the assessment process and the encouragement of student creativity. The study also proposes practical solutions and strategies aimed at helping educators navigate these complexities. this study aims to contribute to the broader understanding of CAD education in high schools, offering insights that can help educators enhance their assessment practices and better support student learning in the field of computer-aided design.

Key words: CAD Assessment, Creative Evaluation, High school education.

I. Introduction

The integration of Computer-Aided Design (CAD) into high school curriculums has become an essential component of fostering creativity and technical proficiency in students. However, assessing CAD designs presents unique challenges, particularly in diverse educational settings such as high schools. Educators are tasked with evaluating a wide range of student abilities, from beginners to advanced designers, while maintaining fairness and accuracy in their assessments. The complexity is further compounded by the subjectivity inherent in assessing creative projects, where innovation and adherence to standardized criteria must be balanced. This study explores the various challenges teachers face when assessing CAD projects, with a specific focus on how these challenges can be addressed to ensure fair and effective evaluation. This research aims to enhance the quality of CAD education in Harare schools, ultimately supporting both student learning and creativity in the field of design.

Statement of the Problem:

The assessment of Computer-Aided Design (CAD) projects in high schools, particularly in Harare, is fraught with challenges due to the diverse range of student abilities, learning approaches, and creative solutions. CAD encourages a variety of problem-solving methods, meaning that students often arrive at different solutions based on their individual skills, perspectives, and creative thinking. This diversity complicates the task of developing a fair and consistent assessment framework. Although marking schemes may include sections to assess creativity, measuring this creativity remains difficult due to the varying dimensions and approaches that students bring to their designs. The subjective nature of evaluating creative work in CAD creates a tension between fostering innovation and applying standardized criteria, making it challenging to ensure that all students are fairly evaluated. This study seeks to explore these challenges and provide practical solutions for educators, ensuring that assessments can accurately capture both technical proficiency and the creativity inherent in CAD projects.

Research questions

1. What are the main challenges faced by educators in Harare schools when assessing Computer-Aided Design (CAD) projects, particularly in terms of varying student abilities and learning approaches?
2. How can educators effectively balance the evaluation of both technical skills and creativity in CAD projects, while ensuring fairness and consistency across diverse student solutions?
3. To what extent can standardized marking schemes adequately capture and assess the creativity of students in CAD projects, considering the diverse and multidimensional nature of student solutions?
4. What practical strategies can be implemented by educators in Harare schools to navigate the subjectivity and complexity involved in assessing creative CAD designs, ensuring a fair and equitable evaluation process for all students?

Theoretical Framework

The assessment of CAD projects in high schools is informed by a synthesis of key educational theories that together address the complex challenge of evaluating both creativity and technical proficiency. Constructivist theory (Piaget, 1976) underscores the idea that learners actively construct knowledge through their interactions with the environment, emphasizing the diverse cognitive abilities and problem-solving approaches students bring to CAD tasks. This theory implies that assessment must be adaptable,

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capturing the individual learning processes students undergo while considering both their skill development and the final product (Piaget, 1976). This perspective emphasizes the diverse cognitive abilities and problem-solving approaches that students bring to CAD tasks. For instance, in a CAD project where students are tasked with designing a sustainable building, a constructivist approach would allow for varied design solutions based on individual students' backgrounds and experiences. Assessment must be adaptable, capturing the individual learning processes students undergo. For example, a teacher might assess a student's design not solely based on the final product but also on their design process, including sketches, revisions, and the rationale behind their choices.

Additionally, Creative Problem-Solving Theory (Guilford, 1967) highlights creativity as a dynamic, multifaceted process, involving divergent thinking (the generation of multiple solutions) and convergent thinking (selecting the optimal solution). In CAD, students engage in both ideation and technical execution, necessitating an evaluation that recognizes the originality of ideas and the effectiveness of their technical implementation (Guilford, 1967). In a CAD context, this can manifest in students brainstorming various design concepts for a product, such as a new piece of furniture. They would first generate multiple ideas (divergent thinking) and then evaluate these ideas against specific criteria (convergent thinking) before creating detailed CAD models. Assessment, therefore, should recognize both the originality of the ideas generated and the effectiveness of their technical implementation. For example, a rubric could be developed that allocates points for creativity in design as well as for technical accuracy in the CAD drawings.

Furthermore, Authentic Assessment Theory (Wiggins, 1990) advocates for real-world tasks in assessment, aligning with the practical nature of CAD design by encouraging the evaluation of students' problem-solving and technical abilities in a context that mirrors professional settings. This approach champions assessments that are not only comprehensive but also reflect the real challenges students will face in the industry (Wiggins, 1990). Together, these theories provide a robust framework for guiding this study, emphasizing the need for flexible, creative, and real-world relevant assessment practices that fairly and comprehensively evaluate students' learning and skill development. This approach encourages the evaluation of students' problem-solving and technical abilities in contexts that mirror professional settings. For instance, a project might require students to collaborate in teams to design a product that meets a specific client's needs, simulating a real-world CAD environment. Assessments could include presentations to a panel of judges (such as local architects or engineers), where students must defend their design choices and demonstrate their technical skills. This not only assesses their final product but also their ability to communicate and justify their work, reflecting the challenges they will face in the industry.

Diversity in Student Abilities and Approaches to CAD Assessment

In the context of CAD education, students exhibit a diverse range of abilities, experiences, and learning approaches, creating a dynamic environment where creativity and technical skill intersect (Jones, 2021). CAD offers students a platform to express themselves, fostering unique problem-solving strategies and innovative solutions, which highlights the need for flexible assessment frameworks (Lee & McManus, 2022). This diversity presents a significant challenge in assessment, as students often arrive at different solutions based on their cognitive processes and creative visions. Traditional assessment frameworks, which may prioritize uniformity, are not equipped to handle the variety of approaches students bring to CAD tasks. As a result, standardized marking schemes become insufficient for fairly evaluating student work in exercises that do not require reproducing diagrams, and alternative methods are needed to capture the complexity of students' creative designs (Jones, 2021). For example, when students are designing eco-friendly products, the range of innovative ideas always make it difficult to apply a one-size-fits-all rubric. Some students may focus on aesthetics, while others prioritized functionality, leading to a rich variety of solutions that traditional marking schemes could not adequately assess. To address this, assessment systems need to shift toward objectivity in evaluating students' proficiency in using CAD software, rather than focusing solely on achieving identical outcomes (Smith et al., 2023). This approach ensures that students are assessed on their ability to effectively utilize the tools and software to navigate design challenges creatively. A flexible, process-oriented assessment system can better reflect the individual contributions of students, fostering a more equitable environment in which creativity and technical proficiency are both recognized and valued (Smith et al., 2023).

Balancing Technical Accuracy and Creative Innovation in CAD Designs

During the early stages of learning CAD, students often focus on reproducing diagrams, allowing them to become familiar with the tools and functionalities of the software. This approach helps them understand the mechanics of CAD systems, often resulting in similar outcomes across different learners (Johnson & McAllister, 2022). However, as students' progress, there is an increasing need to encourage creativity, allowing each learner to explore unique paths toward solutions, a case of individuality in their designs (Henderson & Patel, 2021). These opportunities for students to apply their creativity, helps them to develop a distinctive style that could eventually be valuable in real-world professional settings, where personal branding and creativity are increasingly sought after (O'Connor & Walker, 2023). This shift towards creative expression, however, complicates the assessment process, as standardized marking schemes may not fully capture the diverse, innovative approaches students employ (Johnson & McAllister, 2022). While technical accuracy remains a crucial component of CAD assessment, measuring creativity becomes more challenging, as it is difficult to quantify innovation within a fixed framework (O'Connor & Walker, 2023). As such, educators must develop strategies that assess creativity alongside technical proficiency, ensuring that students' individuality is acknowledged without compromising fairness (Henderson & Patel, 2021). A balance between standard technical accuracy and creative exploration is essential to fairly evaluate students' work, acknowledging both their technical skills and their unique

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design contributions (Johnson & McAllister, 2022). To address these challenges, for example teachers may incorporating peer assessments and self-reflections, allowing students to articulate their design choices and the reasoning behind their creative decisions.

The Subjectivity of Creativity in CAD Evaluation

Evaluating creativity in CAD projects is inherently subjective, especially when using standardized marking schemes. Since CAD allows students to approach problems in diverse ways, existing marking systems often struggle to fairly capture the variety of creative solutions, (Anderson & Miles, 2021). A more flexible assessment approach is needed, one that acknowledges the individuality of each student's design process while maintaining fairness and consistency in evaluation (Jackson & Rivera, 2023). This would ensure that creativity is assessed in a manner that reflects its multifaceted nature, rather than limiting it to predefined criteria.

Practical Strategies for Fair and Effective CAD Assessment

Practical strategies for fair and effective CAD assessment must focus on addressing the complexities of evaluating both technical skills and creativity while ensuring fairness, particularly for high school students. One effective approach is to incorporate authentic assessment, which ensures that the evaluation process reflects real-world tasks and challenges, providing a more dynamic and meaningful learning experience (Anderson & Miles, 2021). Assessments that mirror industry practices can help educators assess students' ability to apply their CAD skills in practical contexts thereby promoting real-world relevance (Barnes & Taylor, 2022). A key element in maintaining fairness is the adaptation of rubrics that balance the need for technical proficiency with the recognition of individual creative expression (Jackson & Rivera, 2023). Rubrics should offer clear, consistent guidelines for evaluating technical accuracy while also allowing room for creative exploration. To further ensure a fair and inclusive evaluation process, incorporating peer reviews and self-assessments provides students with opportunities to reflect on their work and engage with the perspectives of their peers (Barnes & Taylor, 2022). This not only promotes fairness but also fosters a sense of ownership and accountability in the learning process. These strategies can help educators to create an equitable CAD assessment framework that values both technical skills and creativity, ensuring a balanced evaluation for all students (Jackson & Rivera, 2023).

II. Literature Review

Assessing creativity in Computer-Aided Design (CAD) within high schools presents a complex challenge due to the diverse cognitive abilities and learning approaches students bring to their projects. According to Anderson and Miles (2021), effective CAD assessments must move beyond traditional, one-size-fits-all methods to embrace the diversity of solutions students generate. This is crucial because CAD projects offer students a platform to express their creativity, which can manifest in various ways, making standardized assessments insufficient. Similarly, Jackson and Rivera (2023) emphasize the need for rubrics that balance creativity and technical accuracy in CAD assessments. Their research shows that traditional rubrics, which focus on specific outcomes, often fail to recognize the innovative processes that students employ in their design work. This sentiment is echoed by Robinson and Miller (2021), who argue that creativity and originality should be central to assessment criteria, while also stressing the importance of technical precision to ensure a balanced evaluation.

The issue of creativity in CAD assessment is further complicated by the difficulty of quantifying creative outputs. A study by Barnes and Taylor (2022) explores the limitations of standardized marking schemes in capturing the full spectrum of student creativity. The authors argue that creativity cannot be adequately assessed through rigid scoring systems, as students often employ unique and unpredictable methods to reach solutions. In response, they propose integrating formative assessment methods, such as peer and self-assessment, to provide a more holistic view of a student's creative process. This perspective is reinforced by the work of Smith and Green (2021), who found that incorporating self-assessment encourages students to reflect on their learning journey and promotes a deeper understanding of the design process. Their research suggests that assessments should be dynamic, offering room for students to showcase their approaches while still aligning with technical expectations. Furthermore, according to Lee and Rodriguez (2022), evaluations that focus solely on final outcomes risk overlooking the value of iterative processes, which are crucial in CAD projects where students' creative development is often a continuous and evolving process. This dynamic approach aligns with the principles of authentic assessment, which prioritizes real-world tasks and challenges in evaluating student performance (Anderson & Miles, 2021).

Considering these insights, practical strategies for CAD assessment must prioritize flexibility and inclusivity to ensure fairness. Jackson and Rivera (2023) suggest the use of flexible rubrics that allow for creativity while providing clear technical criteria. Such rubrics would allow for a more nuanced understanding of students' skills, fostering an environment where technical and creative abilities are equally valued. Recent work by White and Lister (2022) argues for the integration of digital portfolios, which allow students to track their progress and demonstrate both technical mastery and creative development over time. This strategy promotes a fairer evaluation by considering students' growth and the complexity of their learning processes. In addition, a study by Foster and Wang (2023) emphasizes the importance of peer feedback in CAD assessments, noting that peer review can offer a more comprehensive understanding of a student's abilities, particularly in terms of creativity and collaboration.

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III. Methodology

This study employed a qualitative research approach to explore the complexities of assessing CAD projects in high schools. The research focused on ten CAD teachers, providing in-depth insights into their experiences and strategies. Data collection methods included discussions, observations, and interviews, allowing for a comprehensive understanding of the assessment challenges and practices. Discussions facilitated open dialogues among teachers, revealing common themes and diverse perspectives. Observations of classroom practices provided contextual insights into how assessments were conducted and how students interacted with CAD tasks. Interviews offered detailed, personal accounts of teachers' approaches to balancing technical proficiency and creativity in their assessments.

IV. Findings

Challenges in Balancing Technical Proficiency and Creativity

Teachers face significant difficulties in assessing CAD projects due to the need to balance technical accuracy with creative expression. Students often express confusion about how marks are awarded in open-ended design tasks, questioning why their unique solutions might score differently from others.

Teacher X1 observed, *"Open-ended questions are essential for encouraging creativity, but the challenge is in marking them fairly. Each design is so different, and deciding which is the best can be quite subjective."* Teacher X5 supported this, stating, *"We want students to think creatively, but when it comes to marking, it's tough because each design has its strengths. Comparing them isn't straightforward, and that makes consistent marking difficult."* Both teachers highlight the inherent tension in fostering creativity while maintaining a clear and fair assessment process, emphasizing the subjective nature of evaluating diverse design solutions.

Effectiveness of Current Assessment Methods

Teachers expressed mixed views on the effectiveness of current assessment practices in capturing the diverse abilities and creativity of students in CAD projects. When it comes to reproducing diagrams, they noted that it is relatively straightforward, even if students use different methods. Teacher X1 stated, *"Reproducing diagrams is simpler to mark because you can allocate marks stage by stage. Even if students don't complete the whole design, they can still earn marks for the parts they've finished."*

Teacher X2 agreed, adding, *"Quizzes are easy to assess since they are straightforward, with clear right or wrong answers."* Teacher X6 also supported this view, saying, *"Breaking down the reproduction of diagrams into stages makes it manageable, as students who may not finish can still be credited for their progress."* Teacher X7 echoed these sentiments, emphasizing that stage-by-stage marking ensures fairness in technical tasks. However, when it comes to open-ended questions, the teachers acknowledged the difficulty of assessing creativity. Teacher X2 pointed out, *"Open questions require a design guide, but they also need to leave room for creativity. This makes it challenging to measure the different dimensions of creativity accurately."* The consensus among the teachers was that while structured tasks like quizzes and diagram reproduction are easier to assess, open-ended design questions pose significant challenges due to the subjective nature of evaluating creativity.

Strategies for Ensuring Fairness and Consistency

Teachers shared different strategies to ensure fairness in CAD assessments. Teacher X4 explained, *"I clearly outline all my expectations in open questions, which helps set a transparent standard for students".* Similarly, Teacher X6 mentioned, *"When students question their marks, I compare their designs with the most competent ones, using exemplary work as a reference to address student concerns and maintain consistency in grading".* These insights highlight the efforts teachers make to balance fairness and clarity in the assessment process.

Adapting Assessment Practices for Creative Solutions

Teachers emphasized the importance of flexible assessment practices to accommodate the diverse and creative solutions students produce in CAD projects. Teacher X2 noted, *"CAD software provides students with opportunities to shine, often leading to sophisticated designs."* Teacher X7 added, *"Several times, we had to adjust the marking scheme after seeing students' work on open questions,"* highlighting the need for adaptive grading strategies. Teacher X3 further explained, *"It's easier to create the marking guide after reviewing the work, as CAD allows all students, even those who struggle with traditional drawing, to express their creativity."* These insights underscore the necessity of flexible assessment methods to fairly evaluate the wide range of student outputs in CAD.

Role of Peer and Self-Assessment in Enhancing Fairness

Peer and self-assessment play a crucial role in enhancing fairness in Computer-Aided Design (CAD), as highlighted by teachers who recognize its positive impact on student engagement and learning outcomes. Teacher X1 emphasized, *"In CAD, there is no copying; it's all about how you cope with the software and the flexibility in your approach."* Teacher X5 noted, *"Even when students work together on open questions, each computer shows a different result. They often agree on who has the best design, making the marking process easier."* Teacher X4 added, *"When students collaborate, they can openly discuss their designs and even rate each other's work, which helps streamline the assessment process."* Additionally, Teacher X2 stated, *"This method fosters transparency, allowing students to understand the evaluation criteria better."* Teacher X7 remarked, *"It encourages*

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students to reflect critically on their work and each other's designs, resulting in deeper learning." Teacher X9 expressed, *"Peer feedback is invaluable; students often provide insights that I might overlook."* Finally, Teacher X10 highlighted, *"The collaborative environment nurtures skills that are essential for their future careers."* Collectively, these sentiments illustrate that peer and self-assessment not only promote fairness but also encourage reflective practices and enhance overall student outcomes.

V. Discussion of findings

The findings reveal a complex landscape in which teachers navigate the tension between fostering creativity and maintaining technical standards in CAD assessments. The subjective nature of evaluating open-ended design tasks presents a significant challenge, as each student's solution is unique, making it difficult to establish a consistent and fair grading system. While structured tasks such as diagram reproduction are easier to assess through stage-by-stage marking, the open-ended nature of design questions complicates the process, particularly when it comes to evaluating the creative elements of students' work. Teachers highlight the need for flexible and adaptive assessment practices that can account for the diverse range of student solutions, acknowledging that CAD software provides students with opportunities to showcase their creativity, regardless of their proficiency in traditional drawing skills. The use of peer and self-assessment also emerged as an important strategy for promoting fairness, as students can compare their work with others and engage in reflective practices, making the assessment process more inclusive. This approach allows for a more holistic evaluation, where creativity and technical proficiency are given equal weight. Despite the challenges, teachers are committed to refining their assessment practices, aiming to create a fairer and more consistent system that accommodates the individuality of each student's design while maintaining technical rigor. The findings underscore the importance of striking a balance between flexibility and structure in assessment methods, as well as the value of using student-driven approaches, such as peer assessments, to ensure that the diversity of creative solutions is appropriately recognized.

VI. Conclusion

This study underscores the intricate challenges and opportunities educators face in assessing Computer-Aided Design (CAD) in high schools, particularly in balancing technical accuracy with creative expression. Through the perspectives of CAD teachers, it is evident that while current assessment practices such as staged diagram reproduction offer clarity and fairness, they fall short when capturing the multidimensional nature of creativity inherent in open-ended design tasks. The research highlights the necessity for adaptable, flexible assessment frameworks that allow for individualized evaluation of student solutions while ensuring consistency and fairness. Furthermore, the incorporation of peer and self-assessment proves instrumental in fostering a more inclusive, reflective, and equitable evaluation process. Ultimately, this study calls for a rethinking of CAD assessment practices, advocating for a system that not only measures technical proficiency but also nurtures and acknowledges the diverse creative potential of students.

Recommendations

Based on the findings of this study, the following recommendations are made to enhance the assessment practices for Computer-Aided Design (CAD) in high schools:

1. **Adopt Flexible Assessment Frameworks:** Schools should implement adaptive assessment practices that allow for individualized evaluations. Flexible frameworks can accommodate various creative solutions, ensuring that assessments reflect the uniqueness of each student's work.
2. **Incorporate Open-Ended Design Tasks:** Educators should emphasize open-ended design questions in CAD assignments. Integrating these tasks, educators can foster an environment that values individual design processes while still addressing technical criteria.
3. **Integrate Peer and Self-Assessment:** Actively incorporating peer and self-assessment methods into the CAD curriculum can enhance fairness and inclusivity.
4. **Provide Stage-by-Stage Assessment for Technical Tasks:** Implementing a stage-by-stage marking system for technical tasks like diagram reproduction can ensure clarity and fairness. This method allows students to earn credit for progress, even if they do not complete the entire assignment.
5. **Ensure Transparency in Expectations:** Teachers should clearly communicate their expectations for open-ended design tasks, providing explicit guidelines on success criteria for both technical execution and creative innovation. This transparency can reduce confusion and foster trust in the evaluation process.
6. **Invest in Professional Development for Educators:** Continuous professional development is essential for CAD teachers to stay updated with the latest advancements in CAD software and assessment techniques. The study emphasizes the need for teachers to adapt their marking schemes based on student outputs, indicating a necessity for ongoing training in innovative assessment strategies. Workshops and training sessions can enhance educators' skills in both technical and creative assessment.

References

1. Anderson, H., & Miles, L. (2021). Authentic assessment in CAD: Linking classroom projects to real-world applications. Journal of Engineering Education, 32(4), 126-139.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025

2. Barnes, D., & Taylor, J. (2022). Promoting fairness in CAD assessments through peer and self-assessment. Journal of Design Education, 24(2), 90-102.
3. Foster, S., & Wang, R. (2023). The role of peer feedback in CAD assessments: Enhancing creativity and collaboration. International Journal of Design & Technology Education, 38(2), 221-235.
4. Guilford, J. P. (1967). The Nature of Human Intelligence. McGraw-Hill.
5. Henderson, K., & Patel, S. (2021). Encouraging creativity in technical design: Challenges and strategies in CAD education. International Journal of Engineering Education, 36(5), 1420-1428.
6. Jackson, R., & Rivera, S. (2023). Designing balanced rubrics for evaluating creativity and technical skills in CAD education. International Journal of Educational Technology, 45(1), 55-66.
7. Johnson, R., & McAllister, M. (2022). The role of standardized assessments in CAD education: Navigating technical accuracy and creativity. Journal of Design Technology, 25(3), 65-74.
8. Jones, R. (2021). Assessing creative and technical skills in CAD education. Journal of Design Education, 15(2), 34-45.
9. Lee, A., & Rodriguez, M. (2022). Capturing the iterative process in CAD education: Beyond the final product. Journal of Engineering Education Research, 28(3), 148-160.
10. Lee, K., & McManus, M. (2022). Rethinking assessment practices for CAD in high schools: A modern approach. Technology in Education, 18(1), 52-61.
11. O'Connor, T., & Walker, D. (2023). Balancing technical proficiency with creative freedom in CAD assessment. Journal of Digital Design Education, 18(1), 12-22.
12. Piaget, J. (1976). The Grasp of Consciousness: Action and Concept in the Young Child. Harvard University Press.
13. Popham, W. J. (1997). Classroom Assessment: What Teachers Need to Know. Allyn & Bacon.
14. Robinson, M., & Miller, L. (2021). Reconceptualizing creativity in CAD assessments: A shift toward holistic evaluation. International Journal of Design Research, 19(4), 400-411.
15. Smith, J., & Green, R. (2021). Reflective self-assessment as a tool for fostering creativity in CAD education. Journal of Educational Innovation, 19(3), 200-215.
16. Smith, T., Johnson, A., & Green, L. (2023). Evaluating diversity in CAD assessments: The challenge of creativity and technicality. Journal of Educational Technology, 22(3), 78-89
17. Torrance, E. P. (1974). The Torrance Tests of Creative Thinking. Personnel Press.
18. Vygotsky, L. (1978). Mind in Society: The Development of Higher Psychological Processes. Harvard University Press.
19. White, P., & Lister, C. (2022). Digital portfolios for CAD: A strategy for capturing creativity and technical skill development. Educational Technology & Society, 25(4), 134-145.
20. Wiggins, G. (1990). The Case for Authentic Assessment. Practical Assessment, Research, and Evaluation, 2(2), 1-6.