Enhancing Apparel Pattern-Making Skills in Community College: A Study on the Impact of Visualization Technique

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ABSTRACT

The importance of visualization in teaching and learning is increasingly emphasized in the contemporary education era. However, students need help manipulating apparel patterns due to the lack of visualization skills in pattern drafting, which causes failure in producing good apparel patterns. Thus, a teaching module based on the Meyer Model (1988) has been developed to help lecturers teach visualization skills on apparel patterns. This study aims to evaluate the effect of module implementation on the achievement and skills of apparel patternmaking for first-year students at Community College who take the subject of pattern drafting. A quasi-experimental design was used involving pre-test and post-test. A total of 83 students were selected by cluster random sampling and divided into a control group (40 students) and a treatment group (43 students). The research instrument used is a set of pre-tests and post-tests to measure the achievement and skills of students in manipulating apparel patterns. The results for the aspect of achievement showed that the Kruskal-Wallis test (H = 61.289, p= .001) and the Wilcoxon Signed Ranks test (Z= 7.863, p= .001) indicated significant differences. Similarly, the results for the aspect of skills showed that the Kruskal-Wallis test (H = 59.877, p= .000) and the Wilcoxon Signed Ranks test (Z= 7.738, p= .001) also indicated significant differences, and this shows overall significant differences in student achievement and skills. In conclusion, the Vis Man Pola Module helps lecturers teach and learn to solve student problems in the classroom. The exposure to visualization skills in this module also indirectly guides the user in effectively completing the apparel pattern making.

Keywords: Visualization, apparel patterns, Meyer Model, Community College

INTRODUCTION

Apparel pattern-making is a critical talent for students who aspire to work in the fashion industry. The community colleges in Malaysia are one of the government institutions that provide education and training in this field. Technical and Vocational Education and Training (TVET) in the fashion sector offered promising career opportunities and addressed the demands of an increasingly complex world during the Industrial Revolution. The fashion industry is a dynamic sector constantly evolving, with changes in style, trends, designs, and colours that must be based on market demands and the most recent advancements (Martindale & McKinney, 2016). In this industry, the capacity to generate precise apparel patterns that align with the design vision is essential, necessitating the collaboration of pattern producers and designers. Traditionally, apparel pattern-

making using paper or cardboard templates (Datta & Seal, 2018) is an important first step in production, allowing for efficient fabric cutting and material use. Baytar and Sanders (2020) illustrate that there is variation in pattern-making approaches across educational institutions offering fashilfton and design programs. However, pattern makers need strong visualization and imagination skills. Jamaluddin and Razak (2018) emphasized that visualization skills are vital to creating innovative and attractive fashion designs. Visualization skills are fundamental in making patterns, as discussed by Williamson (2018) and Ramly & Saari (2019), who recognize that this process involves cognitive, psychomotor, and affective aspects. Designers can transform their creative minds into wearable products by designs, manipulating shapes and sizes in their minds and ultimately transcribing them into concrete apparel patterns. However, visualization not only enhances spatial comprehension abilities but also contributes to increased memory and theoretical comprehension in the cognitive field (Özkan et al., 2018; Gunčaga & Žilková, 2019). Therefore, mastering visualization is relevant for creating apparel patterns and is an important skill used across disciplines, enriching the learning process and problem-solving in various contexts. Moreover, the effectiveness of visualization skills in achieving and manipulating apparel patterns is a critical aspect that needs to be emphasized (Ramly & Shaari, 2020).

Apparel pattern-making Fundamental

Pattern making is among the basic principles and fundamentals in the fashion industry, influencing the final product quality and, thus, its success. The foundation of creating apparel begins with a deep understanding of pattern drafting techniques, which include basic pattern drafting, flat patterns, and working patterns (Fink, 2014). Pattern drafting starts from simple and begins using the measurements of standard sizes or model sizes. This basic pattern set comprises five major components: front and back body patterns, front and back skirt patterns, and long sleeve patterns (Naznin et al., 2017). Drafting of a pattern is done to produce the pattern of almost every category because each category of pattern drafting is different from dies. It has various roles in developing usable garments that should be the same as the original design (Shah & Sahil, 2018). Technical aspects and aesthetic qualities are considered along with factors such as user comfort, compatibility with body shape and wear-appropriateness in everyday life (Polit & Hungler, 2013). Fashion design and production create apparel patterns through draping on the dress form to mould fabric over body shapes for a proper fit (McKinney et al., 2016). Designers and pattern makers must work well together to ensure all customers are comfortable and happy with their apparel (Williamson, 2018).

The techniques and processes of apparel pattern-making vary significantly across different countries and individuals, each reflecting unique design philosophies, specific needs, and cultural contexts. In Malaysia, pattern-making is usually organised into steps that include flat patterns and draping techniques. Besides, this method is similar to what is taught in fashion colleges, which includes drawing the pattern and making the garment from the final sample. There are two main methods of doing things in Australia. The first method is to use bought apparel patterns as a starting point for making changes or starting over. Clarke and Holt (2016) said the second method is more personal and based on structural and constructional analysis, and designers like Vivienne Westwood teach this method. Rei Kawakubo, a Japanese designer, also works hard to turn vague ideas into apparel patterns. When Zandra Rhodes makes apparel in the UK, she uses a unique method in which patterned fabric is the main factor determining the pattern. Rissanen (2007) explained that her more modern designs come from printing fabric on paper and then draping that paper over the body before drawing the apparel pattern. A universal technique for making apparel patterns does not exist. Many varied techniques and methods depend on different factors, such as the designer's educational level, cultural backdrop, and design philosophy. This diversity emphasises the significance of flexibility, originality, and adaptability in the fashion design process, whereby the procedure of creating clothes patterns may be seen as a subjective and experimental way to help an individual designer establish his or her personality in his or her works.

Integration of Visualization Skills in Teaching and Learning Apparel Patterns

Visualisation is a cognitive process that requires one to conceptualise, comprehend and geometrically represent ideas or shapes in 2D and 3D (Nordin, 2009). This procedure is directly related to spatial reasoning capabilities, which are thought to be vital for visualising and converting imagined concepts into perceptible types (Madar 2009). Besides, visualisation facilitates individual thinking by translating ideas into realistic forms. It is also vital

in various professions requiring the creation, making, and communication of concepts or images graphically or verbally (Isham, 1997). Additionally, Richards (1995) emphasised that visualisation is a critical skill in clearly communicating product features and adding value in marketing.

In community colleges, particularly in mastering apparel pattern making, visualisation skills are linked to the effectiveness of using visual tools such as drawing and modelling in education. These skills are essential in helping prospective science teachers build a deeper understanding of scientific concepts through drawings (Widodo, 2021; Maduratna & Jayanti, 2022). Also, it is an excellent method to improve the realisation of apparel patterns making. Guide users with accurate step-by-step images, videos, and animation patterns for simpler abstract and complicated steps in pattern adjustment, such as markings, layout, and cutting. The term 'pattern XYZ' will be used for this story- as the audience may not know what a 'profile' means. In addition, the use of visual learning can enhance retention and comprehension (Chen, 2005; McLoughlin & Krakowski, 2001). Thus, it is a necessary approach in pattern-making courses as an innovative tool.

Integrating interactive visual learning materials can increase student engagement and facilitate understanding complex garment manufacturing techniques. Brown (2002) stated that visual literacy is integral to learning, aiding visual thought and idea communication. Students must articulate their ideas clearly through hand drawings or computer design software when learning to modify apparel patterns. These skills enhance their ability to communicate design concepts, improving visual communication skills. Incorporating visualisation skills into apparel pattern-making courses in community colleges can significantly enhance students' understanding of apparel creation and improve their overall learning experience. Visual representation and visual-aided learning foster a deeper understanding of pattern alteration, leading to greater success and efficiency in the field.

Module Development

Model Meyer (1988) provides a structured and systematic approach to module development for technical and vocational education with 13 main steps. Besides, a module is broken down into 60 clear and organised steps to help vocational and technical schools by ensuring students learn in a structured way. The main module development steps: A systematic approach determines the need for a module, followed by a logical progression to determine its format. The third step, methodical analysis, describes student traits. The fourth step, structured development, creates module objectives as behaviour, and the fifth step, strategic decision, sets evaluation criteria to measure learning outcomes. Step six: thoroughly understand, analyse, and know module objectives. Seventh, thoughtful selection is choosing content, and eighth, well-planned selection is choosing teaching activities and media resources. Step nine involves organising learning activities and creating module prototypes. The tenth step involves rigorous target group testing of the module. A thorough review of the module in the eleventh step results in publication if no changes are needed or revision if improvements are needed. All these meticulously designed steps need to be carried out in the order stated in the figure to ensure that the module produced can be used during the teaching and learning process. Next, the 60 steps in Vis Man Pola Module development are as follows:

1. Title establishment
2. Setting up the layout and design of the front cover
3. Completing the title page
4. Completing the table of contents
5. Writing the introduction and program modules
6. Writing the statement of research purpose
7. Providing the curriculum grid
8. Writing the instructions on how to use the module
9. Listing the objectives
10. Listing the background of relevant basic needs
11. Setting and listing the general objectives
12. Detailing the units
13. Setting and listing specific objectives for each unit

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14. Listing equipment and other resources required in the module
15. Providing the pre-diagnostic test
16. Providing the answers for the pre-diagnostic test
17. Interpreting the pre-diagnostic test answers
18. Writing the post-test
19. Writing parallel forms of the post-test
20. Answering all the post-tests
21. Interpreting all the post-test results
22. Selecting the content
23. Organising the content in sequence
24. Selecting activities
25. Completing all the input phases
26. Completing all the process phases
27. Completing all the output phases
28. Refining all written excerpts
29. Writing all excerpts
30. Including statements of each keyword in all important content
31. Writing feedback information for the process phase
32. Writing feedback information for the output phase
33. Writing and placing all questions in the text contextually
34. Including all questions in the text
35. Including all points in quiz feedback for all items
36. Writing all quiz feedback
37. Translating quiz feedback
38. Reviewing entire text using pre-determined criteria
39. Completing all the internal artworks
40. Finalising the layout of all the pages
41. Organising all the units in sequence
42. Providing the front page for all the units
43. Writing the introduction for each the unit
44. Completing specifications for all the audio-visual materials
45. Producing all the audio-visual materials in prototype form
46. Providing a clear lead-in for all the audio-visual materials
47. Clearly stating the follow-up for all the audio-visual materials
48. Providing alternative resources for the students
49. Writing the final refinement and overview
50. Providing annotated reading lists
51. Evaluating the module with instruments
52. Compiling the module in draft format
53. Designing the kit box
54. Completing all writing
55. Reviewing all the elements
56. Completing proof-reading
57. Producing the kit box as a prototype
58. Compiling the module in its final form
59. Conducting the final inspection of each component
60. Reproducing the module in sufficient quantities

The module that has been produced needs to go through the process of testing and verifying draft learning materials, including the visualisation module for designing apparel patterns, which needs to follow three steps as outlined in the Meyer Model (1988). The first step is a test run with an expert, the second is a test run with a small group, and the next is a test run with a representative sample of the class. The test run process at each stage aims to test and validate the draft teaching module that has been built. The first test run was made involving experts as many as three lecturers. After the first test run is made, the draft will be improved according to

comments and findings from experts. The improved draft will be tested in the second and third test runs.

METHODOLOGY

The research design used in this study was quasi-experimental. It was chosen to answer how well the Vis Man Pola Module helps Community College students learn and be good at apparel-making patterns. The research was done in a natural school setting similar to what students face. The quasi-experimental approach permits the researcher to observe the effects of the visualisation module on pattern-making achievement without stringent control conditions while conducting systematic analyses to confirm the module's effectiveness. In this study, the sample size consisted of 83 participants divided into two groups: 43 students in the treatment group from Community Colleges A and B and 40 students in the control group from Community Colleges C and D. All the participants, aged between 18 and 20 years, were selected from four different Community Colleges with similar homogeneous characteristics in terms of educational background. The sampling process involved randomly allocating students into the treatment and control groups. After the completion of the teaching and learning period, the experiment results were measured through post-tests for both the treatment (TG) and control groups (CG) and analysed using statistical analysis methods. The research instruments' content validity was proven through reviews and discussions with experts to ensure that the instruments' items were meaningful, relevant, and complete in measuring the intended constructs. Besides, the reliability analysis showed that the research tool had a high level of internal consistency, with a Cronbach's alpha coefficient of 0.85, which was higher than the recommended 0.70 threshold. This high internal consistency means the research tool gave reliable and consistent results when used on the participants.

FINDING AND DISCUSSION

In this study, the effectiveness of teaching using this module is measured based on the improvement scores obtained through the pre-test and post-test. A non-parametric method was used to test the proposed hypotheses because the data was abnormally scattered. The hypothesis analysis revealed significant differences between the treatment group (TG) and control group (CG) in the pre-achievement, post-achievement, pre-skill, and post-skill tests. Besides, a sub-hypothesis analysis identified significant differences in three sub-skills: preparation, pattern modification, and results. Overall, Ho2 is the only accepted null hypothesis, while Ho1, Ho3, Ho4, Ho4.1, Ho5, Ho5.1, Ho6, and Ho6.1 are rejected.

Table I Non-Parametric Tests for the Hypotheses Conducted

Hypothesis	**Non-parametric Test**	**Results**
Ho1: There is no significant difference in the mean post-test scores between the treatment and control groups.	Kruskal-Wallis test	According to the Kruskal-Wallis test (Kruskal-Wallis = 61.82, α =.001), the mean post-achievement scores of TG and CG differ significantly. The difference between the mean TG = 61.95 and mean CG = 20.55 is confirmed by the Mann-Whitney U test. TG's mean score is higher because of the teaching module than CG, which uses different techniques. Therefore, Ho1 is rejected.
Ho2: There is no significant difference in the control group's mean pre-test and post-test scores.	Wilcoxon Signed Ranks Test	The Wilcoxon signed rank test results for CG (Z = -1.500, P >.134, r = -0.24) indicate that there is no significant difference between the mean pre-test scores (54.00, n = 40) and post-achievement scores (54.75, n = 40). Conventional methods yielded minimal improvement because the post-mean value (54.00) was lower than the pre-mean value (54.75). A tiny effect (2.4%), as indicated by the effect size of r = -0.24. Therefore, Ho2 is accepted.
Ho3: There is no significant difference in the	Wilcoxon Signed Ranks Test	According to the Wilcoxon signed rank test (Z = -5.744, P <.000, r = -0.88), the mean pre-test scores (49.53, n = 43) and post-achievement scores (86.16, n = 43) for TG differ significantly. The

treatment group's mean pre-test and post-test scores.		higher post-achievement mean indicates improved skills with the teaching module (86.16). The significance level, r = -0.88 (8.8%), is low. Therefore, Ho3 is rejected.
Ho4: There is no significant difference in the mean post-skill test scores between the control and treatment groups.	Kruskal-Wallis test	A significant difference between the mean post-skill test scores of TG and CG (Kruskall-Wallis = 59.88, α =.001). This was verified by the Mann-Whitney U test, which revealed a mean TG of 61.72 and a mean CG of 20.80. The teaching module contributed to TG's higher mean post-skill score compared to CG's traditional methods. Therefore, Ho4 is rejected.
Ho4.1: There is no significant difference in mean post-skill test scores between the treatment and control groups.	Kruskal-Wallis test and Mann-Whitney U test	There are significant differences in the mean post-skill test scores for P (44.191), PP (57.134), and H (51.224) at α =.001. These differences were supported by the Mann-Whitney U test, which revealed that TG had greater mean post-skill scores (P = 58.34, PP = 61.12, H = 59.73) than CG (P = 24.44, PP = 21.45, H = 22.94). The teaching module improved TG scores more than CG compared to conventional methods. Therefore, Ho4.1 is rejected.
Ho5: There is no significant difference in the control group's mean pre-skill and post-skill test scores.	Kruskal-Wallis test and Wilcoxon Signed Ranks Test	The pre-test mean (55.30, n = 40) and post-skill test mean (67.10, n = 40) for CG differ significantly, according to the Wilcoxon Signed rank test (Z = -5.424, P <.001, r = -0.86). Despite being modest, the higher post-skill mean indicates improvement because conventional methods were applied. With r = -0.86, or 8.6%, the effect size is negligible. Therefore, Ho5 is rejected.
Ho5.1: There is no significant difference in mean post-skill test scores between the control group.	Kruskal-Wallis test and Wilcoxon Signed Ranks Test	Significant differences in mean postal scores are indicated by the Kruskal-Wallis test results, which are P = 73.600, PP = 65.725, and H = 62.050 (α =.001). The Wilcoxon also shows the differences in the mean CG post-test scores signed rank test (P = -4.323, PP = -4.593, and H = -4.280). Therefore, Ho5.1 is rejected.
Ho6: There is no significant difference in the treatment group's mean pre-skill and post-skill test scores.	Wilcoxon Signed Ranks Test	There is a significant difference for TG (Z = -5.715, P <.000, r = -0.87) between the mean pre-test (49.86, n = 43) and post-skills (90.69, n = 43). The increased post-skill mean showed that the teaching module had a significant positive impact. At 8.7%, the effect size is negligible. Therefore, Ho6 is rejected.
Ho6.1: There is no significant difference in mean post-skills test scores between the treatment group.	Kruskal-Wallis test and Wilcoxon Signed Ranks Test	The mean post-skill scores differ significantly, according to the Kruskal-Wallis test results: P = 94.953, PP = 90.093, and H = 87.139, all significant at α =.000. There are discrepancies in the post-TG test scores, which are further confirmed by the Wilcoxon Signed rank test (P = -5.767, PP = -5.753b, and H = -5.804). Therefore, Ho6.1 is rejected.

Source: Smith (2022)

The first hypothesis showed a clear difference between the control group, which did not use the visualisation module, and the treatment group, which did. Individuals in the treatment group did much better in school, proving that the visualisation module works and showing that technology and interactive teaching methods can help students understand and remember what they have learned. According to Ibyatova et al. (2018) and Tee et al. (2012), teaching modules can provide facilities for lecturers to be facilitators in teaching and learning, which will positively affect students. Specifically, the production of teaching modules is equipped with activities, assignments, assignment feedback and activity implementation steps. This view also aligns with Chen and Zhang

(2022), who explained that teaching effectiveness can be improved using modules compared to conventional methods. Therefore, the apparel pattern teaching and learning module positively impacts students in apparel pattern-making at Community Colleges.

The second hypothesis, which evaluates conventional teaching methods, concludes that the traditional approach significantly fails to improve students' pre- and post-achievement test scores. The weakness of conventional methods is that they cannot raise students' imagination and visualisation abilities, which is critical in technical learning, such as making apparel patterns. According to Wan Mustapha (2017), the conventional teaching method is less effective at this point because the teaching and learning that is implemented only focuses on the content found in the teaching syllabus compared to modules that involve student reinforcement activities. This proves that pre and post-CG achievement scores are still low. Meanwhile, a small effect size involves pre- and post-achievement tests for CG. More clearly, during the implementation of conventional teaching and learning at Community Colleges, based on the evaluation method of dividing marks in the semester system, the pre and post-CG test grades are still at a good level, which is C. However, the performance of these grades is still unsatisfactory and requires follow-up action by lecturers to increase imagination and visualisation in the production of apparel patterns. Therefore, this conventional method should be improved by creating a module that applies visualisation skills in order to help improve student performance to A or A+ level.

The third hypothesis showed a significant difference in treatment group pre-and post-achievement test scores, showing that the visualisation module improves students' comprehension and practical skills. This module's comprehensive, accessible, engaging content boosts learning interest and academic performance. The teaching module is easily accessible because it contains complete learning content, makes it easy for students to use, and can stimulate students' interest (Nurjanah & Suharnomo, 2020). This proof can be evaluated through the pre-TG test grades, which show that most students are at grade D+, which is (a conditional pass), while after using the apparel pattern teaching module, most students get an A grade (excellent). In other words, this finding clearly shows a significant difference between the mean pre and post-TG when using the teaching module during teaching and learning at Community College. Therefore, the achievement of TG students shows an increased performance as a result of the use of the teaching module on apparel pattern-making skills, which helps students improve their imagination and visualisation.

The results of the data analysis provide significant evidence about the benefits of using the Vis Man Pola Module in improving apparel pattern-making skills among Community College students. Hypotheses 4 and 4.1, which evaluate the difference in efficiency scores between the treatment and control groups, found a significant difference, with the treatment group showing higher achievement than the control group. This proves that applying the visualisation teaching module directly increases students' mastery of apparel pattern-making skills, showing the module's effectiveness as a learning and teaching tool. This study is aligned with Avgerinou and Ericson (1997), explaining that with visualisation skills, students will be able to perceive visually, use visual materials to think, and learn and solve problems creatively. Specifically, applying a visualisation teaching module in teaching and learning equipped with activities, assignments, task feedback, and activity implementation steps positively impacts student mastery in teaching and learning. Alsagoff (1981) emphasised that a good module is easy for students to understand and follow.

Additionally, there is evidence that the overall pre-skills test grade results for TG show that most students are at C+ (good) grade and the post-test shows that most students get A+ (excellent) grades. Meanwhile, the pre-skill test as a whole in CG showed that most students were at grade C (good), and the post-test showed that most students got a grade of B+ (honors). Although CG has an increase in skill grade, TG grade shows more improvement due to the mastery of apparel pattern-making visualisation skills that students increasingly master through the teaching modules produced. Therefore, the increasing mastery of visualisation skills is mastered through the modules developed at the Community College.

Moreover, compared to the control group's modest increase from C to B+, treatment group students' proficiency grades increased significantly from C+ to A+, indicating a significant competency acquisition transformation. The visualisation module improves theoretical knowledge and helps students apply skills, which is crucial in vocational education. Hypotheses 5 and 5.1, comparing control group skill scores before and after teaching, found a significant but not an excellent difference, indicating that conventional teaching methods cannot

sufficiently improve visualisation and pattern-making skills. Innovative learning modules are crucial to overcoming traditional teaching methods' flaws. However, the results obtained found that there was an insignificant difference between the pre-and post-test. This can be proven by looking at the results obtained for the pre-test in terms of overall skills for CG students, showing that most students were at grade C (good), and the post-test showed that most students got grade B (honours). However, the performance of this grade is still not encouraging and requires action and follow-up monitoring by the lecturer to improve the students' imagination and visualisation in the production of apparel patterns. This shows that the improvement score is low due to the conventional method still being used. This is supported by Wan Mustapha's (2017) statement that the conventional teaching method is less effective because the implemented teaching only focuses on the content found in the teaching syllabus compared to modules that involve student-strengthening activities.

Hypotheses 6 and 6.1 showed that the treatment group improved much, with most students getting an A+. The module helps students learn how to change apparel patterns. This aligns with Jones and Brown (2019), who say that using pictures and graphics in teaching modules during the teaching and learning process can help students better understand and remember what they are learning. This evidence shows that the level of imagination and visualisation of students increased after using the Vis Man Pola module at the Community College. The result shows a positive achievement with a significant improvement in skills for pre and post-TG students, which illustrates the effectiveness of the teaching module in improving students' understanding and mastery at Community College. Specifically, the findings for the post-test students got an A+ grade (very excellent) for the preparation sub-skill, an A+ grade (very excellent) for the pattern modification sub-skill, and most students got an A+ (very excellent) grade for the product sub-skill. This excellence shows that students can master visualisation and imagination skills in apparel patterns at Community College. This is also supported by the study of Wang et al. (2020), who found that students who are skilled in visualisation and imagination tend to have better academic performance. Therefore, the results of using the teaching module on apparel patterns that are specialised for Community Colleges can help students master visualisation and imagination skills.

The results clearly showed the effectiveness of using teaching modules during the teaching and learning process of apparel patterns at Community Colleges compared to conventional methods. Obviously, the results of evaluation scoring carried out during the final teaching and learning session for apparel patterns at Community College showed improvements. Therefore, these findings clearly indicate that an effective teaching and learning process requires a teaching module, especially for apparel patterns in Community Colleges.

CONCLUSION

In conclusion, the utilisation of visualisation abilities in the instruction of apparel patterns has a beneficial effect on student performance and proficiency in this field. The study found differences in average post-test scores between the treatment group (TG) and the control group (CG). On average, the post-test scores were lower when the control group (CG) used traditional teaching methods than the treatment group (TG), which incorporated the Vis Man Pola Module. Therefore, the Vis Man Pola Module can enhance Community College students' performance and ability to manipulate apparel designs. Moreover, this study has shown that the Vis Man Pola Module outperformed approaches that refute all six hypotheses. In this case, it is essential to integrate teaching modules in Community Colleges in fashion design to promote improved education quality and elevate student achievements.For new methods and protocols, please provide a comprehensive description. Well-established methods can be briefly summarized and appropriately referenced.

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Conflict of Interest

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