Optimising multimodal learning in higher education: a case study of a selected in South African institution

Tshiamo Kgaphola (a) Mamelang Ramathabathe Molaba (b)* Solly Matshonisa Seeletse (c)

(a) Department of Statistical Sciences, Sefako Makgatho Health Sciences University, Gauteng Province, South Africa.
(b) Lecturer, Department of Statistical Sciences, Sefako Makgatho Health Sciences University, Gauteng Province, South Africa.
(c) Professor, Department of Statistical Sciences, Sefako Makgatho Health Sciences University, Gauteng Province, South Africa.

ARTICLE INFO

Article history:
Received 17 January 2024
Received in rev. form 25 Feb. 2024
Accepted 16 March 2024

Keywords:
Higher education, Hybrid, Multimodal, Technology

JEL Classification:
I2

ABSTRACT

The study investigated the shortages in a multimodal learning (MML) approach that was used in a science faculty of a selected higher education institution (HEI) in South Africa. The study population consisted of students of the science faculty. The sample consisted of students who willingly offered to participate after being informed of this study. A study questionnaire consisting of MML components was used to collect data. It was distributed by email as Google forms to students who had supplied their email addresses in acceptance of participating. Analysis of data consisted of graphs and measures in percentages to determine the level of how the students experienced the various MML components. The deficiency level was not too high, but the components that were missing were crucial to effect beneficial learning. The components missing in MML were found to be core components of a flipped classroom (FC). The paper recommended a move of MML closer to FC.

© 2024 by the authors. Licensee SSBFNET, Istanbul, Turkey. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).

Introduction

Multimodal learning (MML) has become the requisite approach to education facilitation mainly because of the unforeseen circumstances such as the Covid-19 pandemic that took place in 2020. It has become the new platform of acquiring education in most universities in South Africa. Some leading universities in South Africa were already in use of the MML approach, while others were coerced to accelerate its usage (Pasara & Mhlanga, 2023). Most of the ones that were already using MML had not reached the best usage levels. Hence, the coerced ones are even worse, as they are far below optimal levels. Modelling the MML is important because it can assist in optimising usage of the modern tools for increased acceptance by the industry. MML includes learning from the convenience of a digital world as an integration of effectiveness and efficient way of conducting business. Higher education (HE) is usually the first sector to support integration of advancing growth in societies. The optimal level of MML in HE is vital. The study sought to elaborate on MML’s numerous components that are useful in making learning better and impactful. These learning components are online classes, online group meetings, recorded sessions of practical’s, visualized items, and auditory items that are used to explain sounds better, among others. These components sometimes also encourage students to receive instructions being outside in natural settings for increased concentration and understanding. These components can help to increase the overall performance of students and the delivery of education.

MML are used in learning to improve education quality and during Covid-19, the mode was used to save education. Resistance to change to comprehensive MML seems to prevail in some HEIs of South Africa, especially after the Covid-19 decline. Consensus is that the whole return to education without technology is no longer possible (Scully, Lehane & Scully, 2021; Biesta, 2022; Liu, Ren, Nyagoga et al. 2023). However, while adopting MML during Covid-19 pandemic lockdowns, some South African higher education institutions (HEIs) are sceptical due to the integrity of academic production, and the way the rampant change would drastically change...
the quality of education. The problem is that while MML has become the modern education obligation, some HEIs in South Africa have not adopted it to optimal levels. This study therefore, investigates the level of optimality of MML in HE, with a special reference to a selected HEI in the country.

The study aims to determine the inclusion of the various MML components in the offering of the selected HEI by identifying what students experience could be missing for their journey to successful learning. The study objectives are four-fold as follows:

i. To determine the extent of inclusion of various MML components in the HEI,
ii. Identify important missing MML components,
iii. To determine a MML component that generates most performance.
iv. To determine missing MML components that could add value to students’ learning.

MML is a relatively new concept that has not yet revealed its optimal level. This study will contribute to satisficing at first, ensuring that the MML components to be incorporated in learning are value adding. Excluded factors that could be beneficial MML components will be identified. The study will also identify MML components of highest contribution. This will be a benefit to learning. Moreover, the study will identify MML components of least or no value, which will be a reduction of detriments to the study. Hence, this study is value engineering.

**Literature Review**

**Multimodal Learning**

Researchers (Bezemer & Kress, 2016; Ester, Nouri & Rodríguez, 2018; Matusiak, 2013; Sankey Birch & Gardiner, 2010) concur that there exists a proliferation of information in several modes, such as gestures, visuals, haptics, auditory productions, text-based information, and multimedia. Representing information through different modes, and/or using a combination of modes, can create multiple access points for, and experience of learning. Giannakos and Cukurova (2023) view MML as a blend of multiple modes of learning through different types of platforms such as online learning and contact learning. These modes are mostly pictures, videos, class recording with old fashion way of contact classes and textbooks with one goal of teaching concepts. According to Buzan (2018), MML submits that when several human senses (visual, auditory, reading, and kinaesthetic) are being engaged during learning, learners comprehend and reminisce more. Azevedo and Gašević (2019) insinuate that through a combination of the MML modes, students experience learning in assorted ways to create a diverse but gratifying learning style. In addition, Byrne (2014) view MML as an attempt to model the mixture of different modalities of data, often arising in real-world applications.

HE in South Africa has been the leading sector in education, which develops much faster than the secondary school and primary school. The transformation has been positively supported as it seeks to address the challenges that students experience with missed classes or missed information due to low concentration in class. The drive to upgrade education is a positive initiative for both institutions and stakeholders as information can be shared much efficiently and be backed up on cloud computing platforms.

**MML in Higher Education**

Junokas, Lindgren, Kang et al. (2018) explain that technology has greatly contributed to the development of education. Students can reflect on recordings that have module content. They can access the lessons repeatedly as compared to olden days where education was acquired from physical classes that were not recorded. Kosmas, Ioannou and Retalis (2018) explain that this has contributed greatly to students studying patterns. This upgrade addressed matters with convenience for both staff and students as students can attend anywhere comfortably and at their convenience. Lecturers can pre-record lessons and upload. Moreover, it helps stakeholders review and revise their schedules and simultaneously do other related work. Information acquired is much greater than before.

Sharma and Giannakos (2020) view MML as an emerging field of research with inherent connections to advanced computational analyses of social phenomena. They counsel that MML can assist in monitoring learning activity at the micro-level and model cognitive, affective, and social factors associated with learning using data from both physical and digital spaces. MML therefore, provides new opportunities for supporting the learning of students.

**MML Purpose**

Kalantzis and Cope (2015) point out that in today’s increasingly fast-moving digital world, learners are immersed in multimodal online communication environments in their daily life, through Facebook, Twitter, Instagram, Snapchat and others. This requires educators to reflect the environment in which these learners live, and thus design instructional practices from a multimodal perspective. Multimodality offers new opportunities for digital learners to express themselves, analyse problems and make meaning in multimodal ways as they interpret knowledge differently according to their various educational needs. Celestine (2016) defines value engineering (VE) as an organised effort focused on analysing premeditated constructing features, systems, equipment, and material selections to achieve essential functions at the least cost or least detriments but with improved performance, quality, reliability, and safety. When designing MML, a systematic approach is necessary, and VE can be handy in this study. Kinzer, Leu and Peters (2017) views the ubiquitous use of digital technologies as continually reshaping the ways individuals access information.
share ideas, and communicate with one another. Doing so requires the nimble use of skills, strategies, and mind-sets to navigate, communicate, and collaborate online and across multiple contexts. These changes have profoundly affected instructional choices in education. In today’s education landscape, three key motivations challenge traditional notions of teaching and learning and set forth a strong case for multimodal learning as a critical pedagogy.

McMurtie (2021) states that there have been instances of success even in these challenging situations. Teachers and schools have adapted the curriculum to meet learners’ needs in ways that will provide examples for strong instruction in subsequent years. A recent survey of HE faculty found aspects of online instruction worth keeping even after a return to fully in-person instruction is possible. These aspects included virtual workshops, virtual tutoring, flexible due dates, and using digital tools to make connections with students.

**MML Downsides**

Sullivan (2022) identifies factors that have negatively impacted learning as inclusive of disparities in access to technology or internet, frustration with distance instruction, and lack of support. The instance of technology incorporation during the pandemic is, in and of itself, a case study in what not to do. Teachers and schools have been asked to incorporate existing technology first and figure out how to align the devices or programs capabilities with excellent instruction after the fact (that) exact opposite of what is recommended.

Several authors (Kanekar, Snyder & Prince, 2023; Maddukelleng, Jihan, Gunawan et al., 2023; Rodrigues, 2023) concur that online and hybrid teaching challenge some educators. It challenges mostly those who hold back adoption or use because they do not feel prepared to meet instructional goals with those tools despite them looking favourably on technology for instruction. Asking educators to successfully migrate their entire instruction approach to online learning modes led to educational difficulties in all areas of the United States (Dhawan, 2020; Palloff & Pratt, 2010; Sun & Chen, 2016). Students struggle in learning and retention in ways that are not yet fully understood.

**Traditional Learning vs MML**

Lee-Cultura, Sharma and Giannakos (2023) agree that there have also been direct student benefits, such as the opportunity to become fully digitally literate, a skill sought after by employers. While the temptation may be there to move students back into fully in-person instruction after such a stressful experience, the ever-evolving pandemic may require schools to move forward with more emphasis on technology than would have been conceived of even one year ago. It is important to build on the strengths of technology-based instruction. This includes a thorough understanding of the student perspective.

**Methods**

This section briefly discusses the research methods used to accomplish the study objectives, including study design, population and sample, data collection, and data analysis. The study design was quantitative of categorical form, requiring use of categorical data analysis (CDA). CDA involves examining of data that classifies observations into several categories (Muniz & Oliveira-Filho, 2023; Tang, He & Tu, 2023). These of dataset types are shared in various fields of applications where numbers need to be (analysed). The analysis is essential for gaining insights from qualitative data and making informed decisions in various domains. The method used in analysing categorical data is CDA, which refers to the analysis of data where the response variable has been grouped into a set of mutually exclusive ordered (such as age group) or unordered (such as no/yes). (Kandethody, Ramachandran & Tsokos, 2021). The study population consisted of undergraduate science students of a selected HEI in South Africa. The study used primary data where a structured questionnaire containing MML items to tick and spaces for comments was distributed amongst (80) participants who had send return messages to indicate that they were willing to participate. Data collected using structured questionnaire were used to make the analysis. It consisted of the participants requiring to indicate if they found their MML to be containing:

i. Visual techniques
ii. Auditory techniques
iii. Enables movement
iv. Persuading critical thinking
v. Prompting practical application
vi. Improving attitude to learning
vii. Arousing student attention
viii. Propelling student engagement
ix. Inducing creativity
x. Encouraging teamwork
xi. Encouraging multi-sensory learning
xii. Enhancing quality
xiii. Enabling increased study content
xiv. Allows adequate feedback
xv. Improves attitude to learning
The respondents were also asked to name any items that were not listed they found it necessary to include them in MML and indicate reasons. Data analysis on categories’ frequencies was done using Excel to generate bar graphs and correlation tables. The qualitative input data were analysed using thematic content analysis technique, which develops themes from the sentiments of the participants (Morgan, 2022). The values and principles of ethical research in the business and social sciences guided this study. Before the participants could (make) a decision on whether they wanted to participate or not, the researchers provided them with the purpose and a comprehensive outline of the study. The researchers treated the research participants with respect. They also upheld confidentiality in which participants’ identities and views were kept anonymous.

Results

The CDA results are presented first by indicating the level at which the participants showed occurrences of the various MML items in the areas of their learning.

Exhibit 1 above shows that items posing serious learning compromises are ‘enabling movement’, ‘encouraging teamwork’, ‘restricting honest assessment’ due to most participants stating that they are lacking. Other MML items to watch, though not as serious, were ‘prompting of practical attention’, ‘propelling student engagement’, ‘enhancing quality’, and ‘arousal of student attention’. The above graph shows frequencies of modes of MML that are present in the faculty of science.

<table>
<thead>
<tr>
<th>Mode or Item</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enables movement</td>
<td>18</td>
<td>62</td>
</tr>
<tr>
<td>Encourages teamwork</td>
<td>29</td>
<td>51</td>
</tr>
<tr>
<td>Restricts honest assessment</td>
<td>32</td>
<td>48</td>
</tr>
</tbody>
</table>

Exhibit 2 shows that for most students, MML failing to ‘enable movement’ is the highest incidence of the items where non-occurrence exceeds occurrence of an item. The other item of most serious worry is failure to encourage teamwork. The integrity is compromised in the item ‘restricting honest assessment’. However, the assessment of ‘No’ is encouraging because more people do not feel that there is dishonesty. The concern with the items is that there is a notable proportion (40%) who think that MML does not prevent dishonest assessment. Other areas of concern have been mentioned even though they are less serious than the leading ones. They are now displayed in a visual display as well, where there are more responses indicating deficiency (No) than Yes response.
The above exhibit demonstrates that even though the positive area/item (i.e those coming with ‘yes’ responses) are showing to be more than the disappointing ones (the ‘no’ answers), the red portion is not too far smaller than the blue portion. This illustrates that these negative ones are very close to, and therefore comparable with, the desirable ones. Specifically, MML showing to be unable to arouse student attention in about 48% cases is a worry. The same applies when MML does not enhance quality in about 46% cases of students, not propelling students’ engagement in about 43% cases, and also not prompting practical application in about 41% student cases.

There are areas/items of MML that may be considered more commendable, in light of that they are showing much more positive of MML provision despite the short history of this approach to teaching. In the next bar exhibit, these items are illustrated by less red portion (indicating hazard)

In this exhibit, the shortest red is the most desirable, as the red is nonconformity to desirable extent, or maximum. Therefore, among the commendable ones, ‘improving attitude to learning’ is the most worrying because it has the longest red. The second worrying are ‘coercing reflexive teaching’ and ‘inducing creativity’ at equal levels. The list continues according to the chart bars from left to right (or table rows upwards) till reaching the last one ‘entails auditory techniques’. On total progress, the frequencies are combined/added to determine the extent to which positive responses that show where MML items were met, compared to what was not achieved. The next exhibit displays the extent of progress made.
In the added frequencies, the item ‘Restricting honest assessment’ was changed to become ‘Enabling honest assessment’. This made this item desirable with a ‘Yes’, and then the frequencies were added so that all the ‘Yes’ responses are favourable towards MML. The road to full MML after combining the desired items shows that a massive 89% progress has been impressed.

**Discussion**

The components of MML were investigated, and Exhibit 1 highlighted that ‘enabling movement’, ‘encouraging teamwork’, and ‘restricting honest assessment’ undermined the MML progress. The deficiency/shortage level, which describes the ‘No’ responses, for ‘enabling movement’ was deficient by about 78%, ‘encouraging teamwork’ was deficient by about 64%, and ‘restricting honest assessment’ was deficient by about 60%. These deficiency levels are calculable from Exhibit 2 numerals.

Other MML components of high deficiency but of less deficiency levels than the earlier three, calculable from Exhibit 3 numerals, were ‘prompting of practical attention’ at deficiency level of 41%, ‘propelling student engagement’ with deficiency level of 43%, ‘enhancing quality’ with efficiency level of 46%, and ‘arousal of student attention’ with efficiency level 48%.

Exhibit 2 shows MML prevented most students from having physical movement at high level. Lack of physical movement disrupts proper flow of blood (Sinnott, Cleary & Harrison, 2023). Joyner and Casey (2015) inform that poor blood circulation can lead to symptoms such as numbness, tingling, swelling, pain, and muscle cramps, and can also cause complications such as nerve and tissue damage, heart attack, and stroke. As poor blood flow also brings discomfort, Vita, Vianello and Vita. (2023) points out that poor blood flow could also affect easy breathing.

The other item of most serious worry is failure to encourage teamwork. MacAlpine and Stone (2017) insinuate that poor teamwork can result in a drop in performance of many students and reduced effectiveness, as students may focus on individual tasks rather than sharing ideas and exchanging content learned in MML settings. According to Boss, Pels and Kleinert (2023), shared responsibility on difficult concepts would also lack due to failure to exchange ideas. Collective student vision is not possible due to them being in silos. Student support between student groups is closed as well. Lacking teamwork also causes stress, which would prevent innovative ideas from students. Collaboration of fellow students is also impossible.

The integrity is compromised in the item ‘restricting honest assessment’. The result of this actions are reduced quality and the integrity in that department (Baijnath & Singh 2019). Dishonest assessments can have serious consequences for students, institutions, and society. Obvious worries of academic dishonesty are the penalties that universities can impose on students, including fines, loss of future projects to the university, expulsion, suspension, warning, or lawsuits. Other penalties include serious moral, ethical, social, and academic concerns, such as questions of academic integrity and ethical conduct, weakening students’ self-esteem and confidence, and ruining their reputation (Northern Illinois University, 2023). Engaging in assessment malpractice fosters a culture of dishonesty, undermines the principles of fairness and meritocracy, and devalues hard work. Dishonest assessment also has harmful effects on the learning process, which may cause increased stress and anxiety levels. It therefore compromissess personal growth and diminishes the value of qualifications. Therefore, MML can lead to the far-reaching effects on academic dishonesty and the important attribute of academic integrity.

MML underperformed in prompting practical application. The importance of applying knowledge to real-life situations cannot be overemphasized. Baird and Mollen (2023) point out that acquiring knowledge without putting it into practice is not helpful. There is value of practical application and real-world experience in conjunction with learning.

To some degree, MML was not propelling student engagement. Dubey, Pradhan and Sahu (2023) explain that student engagement is essential for countless reasons, a few of them being impact on academic achievement, motivation, and overall well-being of students. Some key benefits of student engagement are higher academic performance, upgraded motivation, enriched cognitive and emotional development, lifelong learning, and connection with values, interest, and goals.
The concern of MML does not enhance quality. Quality in teaching and learning implies providing equitable, inclusive, and standardised education that stimulates lifelong learning, and prepares students for participating actively in society (Shaeffer, 2019). Quality education is a modern way to fight poverty and improve economies. It is therefore important to address the issue of poor education quality to reduce poverty and exploitation, and to encourage national development, and economic progress and well-being for individuals and society as a whole.

Related to student engagement, MML seems to have not optimally stimulated student attention. If students do not listen carefully to their teachers, Tomlinson and Imbeau (2023) indicate that they are likely going to perform poorly in their assessments. These deficiencies show that MML lacks some attributes of a flipped classroom (FC), where a flipped classroom is an instructional strategy aiming to intensify student engagement and learning by having students reading before lectures and/or watch pre-recorded lectures at home, freeing up class time for activities that involve higher order thinking, such as problem-solving, discussion, and collaboration (Sointu, Hyypiä, Lambert et al., 2023). Nurtamam, Santos, Ilwandri et al. (2023) point out that in a FC, students encounter information before class, take responsibility for their learning, and learn rather than encounter material in class. The primary objectives of flipping are to make the classroom an active learning setting, enable students to learn at their own pace, and give the instructor more time to attend each student individually. The FC model comprises plenty work by students outside of class, and teachers should note factors such as technology access, non-traditional students’ outside responsibilities, the physical classroom setup, and group assignments that permit all students to feel comfortable.

**Conclusion**

There are many opportunities offered by the MML, but also inherent limitations as shown with MML deficiencies. Integrity of MML usage, and the issues of quality, which are vital attributes in modern education provision are both questioned. The failure of MML to take a lengthy period with no or limited break place students in a compromising situation. The consequences of not lack of movement can lead to risk such as blood clots, stress, heart attack and stroke. Quality, which is indispensable for improving country’s stability, was shown to also lack. Attentive attendance, student engagement, practical application, teamwork, and honest assessment, fashion the blend of MML inadequacy. It also became clear that the attributes missing in the MML of the investigated HEI are present in FC setting. This paper recommends aligning the MML practice to FC.

In particular, the learning facilitator in MML should

i. Create or find resources (e.g., video lectures, assigned readings) to deliver the foundational knowledge to students before class to develop materials,

ii. Design in-class activities that promote higher-order thinking, such as problem-solving, discussion, and collaboration in order to engage students, and

iii. Provide support to students as they work through the new material and engage in active learning during class time as student support.

**Acknowledgments**

We acknowledge the support we received from Mr OP Mokoena for setting the platform for the research services of the departments, and Mr GR Mokoena for the mentoring he provided for some team members in the authorship of this paper. Mr G Rakale was also part of the supervisory team for some students in the departments, we also acknowledge his assistance. For the payment towards publication, the secretary was involved in paper work. She is also duly acknowledged.

All authors have read and agreed to the published version of the manuscript.

**Author Contributions:** Conceptualization, T.M., R.M.M. & S.M.S.; Methodology, T.M., R.M.M. & S.M.S.; Validation, S.M.S.; Formal analysis, T.M., R.M.M. & S.M.S.; Investigation, S.M.S.; G.E.M & M.W.L.; Resources; Writing—original draft preparation, R.M.M.; Writing—review and editing, T.M., R.M.M. & S.M.S.

**Funding:** This research article received no specific funding or grants. The Sefako Makgatho Health Sciences University (SMU) provided financial support for the editing and publication of this article.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** The data presented in this study are available on request from the corresponding author. The data are not publicly available due to restrictions.

**Conflicts of Interest:** The authors declare no conflict of interest.

**References**


Sullivan, P. M. (2022). From the student perspective: An analysis of in-person, hybrid, and online learning during the pandemic. In Cases on innovative and successful uses of digital resources for online learning (pp. 80-95). IGI Global.


Publisher’s Note: SSBFNET stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

© 2024 by the authors. Licensee SSBFNET, Istanbul, Turkey. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).