Multi-Modality Learning: Overview and Its Effects on Learner Engagement in the Twenty-First Century

Sojira Karnasuta

Business English Communication International Program, Faculty of Liberal Arts, Thammasat University
Room140 Paholyothin Highway, Klongluang, Pathum Thani 12120, Thailand

`sojira@tu.ac.th`

Abstract—**This study reviews the topic of multi-modality learning in this digital age, as well as examines the possibilities and limitations of its effect on student engagement and learning outcomes. Multimodal learning can be explained as the usage of several instructional methods in educating student; they are text, image, audio, or technology-enriched tool. Due to the increasing interest in incorporating multi-modality technique in teaching and learning, this review will include the following topics: theoretical definitions of multi-modality learning; background on multi-modality learning and methods; application and benefits of using multi-modality technology in various education fields such as language, science, medicine, and statistics; and its influences on student engagement and learning outcomes.**

Keywords— **Multi-modality, Learning tool, Learning technology, Multimodal learning, Learner engagement**

I. INTRODUCTION

Multimodal learning is very common in real world education. Many learning environment are often involved different teaching methods. Given recent developments in digital technologies, multimodal representation, which combines texts, images, sound, graphic and other modes, has been created and used in language and communication, as cited by Bezemer & Kress, 2008 in [1]. Even if using various technologies does not affect how the human mind works, well-designed instructional technologies can be a powerful tool to increase human cognition, as in [2]. Therefore, multimodality has become a topic of growing interest in improvements in learning and teaching environments in recent years. This study aims to review the topic of multi-modality learning in this twenty-first century, as well as examines the possibilities and limitations of its effect on student engagement and learning outcomes. This review will also include the following topics: theoretical definitions of multi-modality learning and background on multi-modality learning and methods; application and benefits of using multi-modality technology in various education fields such as language, science, medicine, and statistics; and its influences on student engagement and learning outcomes.

II. THEORETICAL DEFINITIONS AND BACKGROUND OF MULTIMODAL TECHNIQUES

In Schnotz & Lowe (2003), multimedia is defined as a combination of several technical resources aiming to represent new technologies and information, as cited in [2].

These instructional technologies are considered as the primary resources of multimedia learning environments and have been classified according to the sensory perception as follows: visual media, audio media, and audiovisual media. Visual media include, for example, books, whiteboards, pictures, charts, graphs, real objects, or models; while audio media includes radio, records, cassettes, and audio tapes; and audiovisual media are films, animations, television, and video, as in [2]. Bezemer & Kress (2008) in [1] defined multimodal composing (MC) as "socially and culturally shaped resources for making meaning." In order to analyse interaction of MC, we first need to understand the communicative modes. Reference [3] shows that modes such as proxemics, posture, head movement, gesture, gaze, spoken language, layout, print, or music, are essentially systems of representation. This system of representation or communicative mode is a semiotic system with rules and regularities attached to it and is always a heuristic unit, highlighting the difference between the system of representation and the real-time interaction among social actors. Just like writing language, one example of a system of representation, that its system can be described in the form of dictionaries and grammars, we could describe other systems of representation like gesture, gaze, layout etc. in a similar way by developing certain dictionaries and grammars of these communicative modes.

Not only the use of multiple resources in teaching and learning, multimodal curriculum is also another important learning influence, as in [4]. Multimodal curriculum emphasizes on students producing documents beyond traditional print-based texts native to a digital environment; however, instructors need to ensure that not only it engages students, it should enable students to learn rhetorical concepts behind creating multimodal texts – one such way is through assessments.

Social semiotics or the study of signs and symbols and their use in society is embraced as one approach to research multimodality, as in [5]. Started from Halliday's theory of language in 1978 and 1994, several development and subsequent adoption of social semiotic frameworks are seen in analysing other types of resources other than language, for example, images, sound, and three-dimensional space, as well as their interaction with each other and with language [5].

As technology developed and cost-reduction are taken into account, internet-based education platform, so-called Massive Open Online Courses (MOOCs), is potentially

increased in interests [6]. Internet-based distance learning can be divided into two main methods: asynchronous and synchronous ones. Using asynchronous methods, learners receive static instructional content and develop their critical thinking through posts and blogs with instructor and classmates, such as Blackboard.com. While synchronous methods offer instructional content in real time, students can get immediate feedback, clarification and remediation from instructor and classmates right away. This is proved to increase student satisfaction and improve communication, as cited in [6]. Moreover, online students can communicate through technology in multiple ways, i.e. asynchronous discussion boards, course blogs, videoconferencing, nonlinear classroom environment etc. [4].

III. APPLICATIONS AND BENEFITS OF MULTIMODALITY

As cited in [1], growing interests and researches in the use of various forms of multimodal composing (MC), e.g. video production and audio podcasting, are found in various setting, including urban public schools with linguistically diverse English language learners in the U.S., a secondary school in Kenya, and mainstream university ESL/EFL courses in Hong Kong and Taiwan. Moreover, combination uses of multimodal presentation software with interactive whiteboard is also explored among English learning students in an elementary school in Taiwan [7] and using task-based design in multimodal environment of German language learning students [8]. Study conducted in [9] also reviewed the effects of multi-sensory art modalities on vocabulary acquisition and found that uses of visual art and tactile to facilitate language learning aspects are considered to be positive. Their study also suggested that English language teachers should encourage learners to use artistic modalities, as well as kinetic activity, more consciously than they are currently used.

More empirical studies in language learning are also found in [4], [9] and [10]'s works. Comparison of using multimodal composition between online and face-to-face in first-year composition courses is also explored in [4]'s work. They found that main reasons for differences between the two are self-selection, instructional assistants, nonlinear learning environment, and teaching technology. Self-selection suggests that students who performed better might generally be more comfortable with technology. Having instructional assistants also helps online students to have immediate access to tutors for every project, contrary to face-to-face students who have to visit the campus-based tutoring centre. Last, in nonlinear learning environment, online course tends to offer more robust reflection, enabling learners to simultaneously relearn and revisit certain concepts in their learning process. However, some may argue that such differences are just common in online environment, but some factors, e.g. instructional assistants, still play significant roles in improving student learning of multimodal literacies, as discussed in [9]. Reference [10] pointed that 3D multimodal resources in Second Life visually and linguistically support EFL learners, as well as facilitate language teaching and learning.

Other than language teaching, a Science, Technology, Engineering, Arts and Mathematics (STEAM) classroom has also adopted various multi-sensory technologies [11]. The researcher identified several multi-sensor tools in his study as follows: virtual reality, tablet computers, JAWS or a text-to-speech screen reader, and SALS or a glass wand with an embedded light sensor and noted on better engagement and increased learning outcomes [11]. In medical media analytics, reference [12] incorporated the use of two types of magnetic resonance images (MRI) as multi-modality images to provide image-based information for disease prediction and the results demonstrated promising superiority of the introduced strategy in comparison to several existing ones. Another work by [13] also highlights a common multi-channel framework for THz pulse imaging and DCE-MRIs to provide better software standardization. Other applications include using multi-modal and multi-type features for accurate identification of Tourette syndrome children [14] and applying and adjusting approaches of multi-modality medical image fusion technology in better dictionary learning, resulting in complete, informative and compact medical image [15].

IV. TS INFLUENCES ON STUDENT ENGAGEMENT AND LEARNING OUTCOMES

Reference [2] suggested that multimedia play an important role in improving student motivation and achievement by means of using various resources to address one sensory organ. In STEAM classroom, reference [11] reported benefits of using multi-sensory technologies in education which are student engagement and improved learning outcomes as they allow students to learn in their preferred learning styles and make learning fun and connected to real-life situations. Specific benefits of using multimodality in various fields, as well as its limitation, are discussed below.

A. Engagement

Young people's language and literacies in everyday practices both formal and informal learning spaces are studied in [16] and suggested (1) a refocus of multilingualism towards an examination of different dimensions of modalities and language varieties in languaging practices, (2) the recognition of student positions as central to their nature of language practices, and (3) "an exploration of this shaping in relation to frames established by the pedagogical practices, administrated by teachers." Although multilingual-multimodal languaging practice was less adopted than essay-like formal learning outcomes in school-based literacies, its promotion of young people's engagement in learning processes as tasks-in-progress is found as often as the latter. When the multimodal modes are employed, the learner roles are enabled and have the potential to interact with practices and audiences outside formal educational settings [16].

Another pilot study by [6] proved that using a synchronous internet-based learning platform in a multi-user virtual environment, such as Venuegen.com, for Family Nurse Practitioner students can result in greater student engagement compared to asynchronous learning platform, such as Blackboard. However, the results indicated that such increase in engagement appeared to be cognitive presence rather than social presence.

Not only studying about it multimodality effects on student motivation, in Chinese EFL classroom, reference [1]'s study revealed that the motivational sources of multimodal activity in English learning came from seven factors: challenge, curiosity, control, fantasy, cooperation, competition and recognition that students experienced after the implementation of multimodal context in the classroom.

B. Learning Outcomes

It was found in [17] that multimodal teaching and learning with Social Network Service-based writing platform have a positive learning effect in L2 university students (LPS)' writing performance, as well as invoking learners' motivation and enhancing peers' collaboration. In this context, multimodality has been proven to influence LPS three main domain: presence, challenge, and efficacy. Sense of presence, or the awareness of co-presence, learners were enabled to voluntarily involve in the writing activity, establish close relationship with an instructor and experience collaborative learning with peers. Challenge is next proven to develop and enable learners to feel their writing proficiency improved and learners' challenge increased positively. Lastly, leaners' efficacy helped the students to develop their ability to recall acquired knowledge and experience a sense of achievement from attaining set outcomes.

C. Limitations

Some limitations are highlighted in [5]. Although multimodal materials may enhance teaching and learning, teachers still play a critical role, to support students' efforts to understand abstract terms especially across culture, to use a particular word, and to guide and integrate with other classroom activities, as discussed in [5]. Further research in developing evaluating methods of the effectiveness of multi-modal interaction in language teaching and learning is also recommended.

V. CONCLUSIONS

This paper has presented an overview of using various communicative modes in this digital age, especially its influence on student engagement and learning outcomes. It also considers the application and benefits of using multi-modality technology in various education fields such as language, science, medicine, and statistics. However, there is still much to be explored as technologies continue to develop.

REFERENCES

[1] L. Jiang and J. Luk, "Multimodal composing as a learning activity in English classrooms: inquiring into the sources of its motivational capacity," *System*, vol. 59, pp. 1-11, Jul. 2016.

[2] M. Gunel and F. Yesildag-Hasancebi, "Modal representations and their role in the learning process: a theoretical and pragmatic analysis," *Educational Sciences: Theory & Practice,* vol. 16, pp. 109-126, Feb. 2016.

[3] S. Norris, *Analyzing Multimodal Interaction a methodological framework,* Oxon, UK: Routledge, 2004.

[4] A. Bourelle, T. Bourelle, A. V. Knutson, and S. Spong, "Sites of multimodal literacy: comparing student learning in online and face-to-face environments," *Computers and Composition*, vol. 39, pp. 55-70, 2016.

[5] S. Vungthong, E. Djonov, and J. Torr, "Images as a resource for supporting vocabulary learning: a multimodal analysis of Thai EFL tablet apps for primary school children," *TESOL QUARTERLY*, vol. 51, no. 1, Mar. 2017.

[6] F. L. Claman, "The impact of multiuser virtual environments on student engagement," *Nurse Education in Practice*, vol. 15, pp. 13-16, 2015.

[7] F. Kuo, P. Yu, and W. Hsiao, "Develop and evaluate the effects of multimodal presentation system on elementary student learning effectiveness: within classroom English learning activity," *Procedia – Social and Behavioral Sciences*, vol. 176, pp. 227-235, Feb. 2015.

[8] Z. I. Abrams, "Possibilities and challenges of learning German in a multimodal environment: A case study," *ReCALL*, vol. 28, no. 3, pp. 343–363, Sep. 2016.

[9] B. Gorjian, A. Hayati, and E. Barazandeh, "An evaluation of the effects of art on vocabulary learning through multi-sensory modalities," *Procedia Technology*, vol. 1 (2012), pp. 345-350, 2012.

[10] J. Chen, "The crossroads of English language learners, task-based instruction, and 3D multi-user virtual learning in Second Life," *Computers & Education,* vol. 102, pp. 152-171, Nov. 2016.

[11] J. Taljaard, "A review of multi-sensory technologies in a Science, Technology, Engineering, Arts and Mathematics (STEAM) classroom," *Journal of Learning Design,* vol. 9, no. 2, pp.46-55, 2016.

[12] W. Huang, S. Zeng, M. Wan, and G. Chen, "Medical media analytics via ranking and big learning: a multi-modality image-based disease severity prediction study," *Neurocomputing,* vol. 204, pp. 125-134, Sep. 2016.

[13] X. Yin, Y. Zhang, J. Cao, J. Wu, and S. Hadjiloucas, "Exploring the complementarity of THz pulse imaging and DCE-MRIs: toward a unified multi-channel classification and a deep learning framework," *Computer Methods and Programs in Biomedicine,* vol. 137, pp. 87-114, Dec. 2016.

[14] H. Wen, Y. Liu, I. Rekik, S. Wang, Z. Chen, J. Zhang, Y. Zhang, Y. Peng, and H. He, "Multi-modal multiple kernel learning for accurate identification of Tourette syndrome children," *Pattern Recognition,* vol. 63, pp. 601-611, Mar. 2017.

[15] Z. Zhu, Y. Chai, H. Yin, Y. Li, and Z. Liu, "A novel dictionary learning approach for multi-modality medical image fusion," *Neurocomputing*, vol. 214, pp. 471-482, Nov. 2016.

[16] A. Gynne and S. Bagga-Gupta, "Languaging in the twenty-first century: exploring varieties and modalities in literacies inside and outside learning spaces," *Language and Education,* 29:6, pp. 509-526, Jun. 2015.

[17] K. Lee and B. Kim, "Cross space: the exploration of SNS-based writing activities in a multimodal learning environment," *Educational Technology & Society,* vol. 19(2), pp. 57-76, 2016.