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RELATIONSHIP BETWEEN MULTIPLE INTELLIGENCES AND DIGITAL LITERACY SKILLS AMONG UNIVERSITY STUDENTS

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ABSTRACT

This study investigates the relationship between multiple intelligence (MI) and digital literacy among university-level students. Drawing on Howard Gardner's theory of multiple intelligences & contemporary understandings of digital literacy, research explores how different intelligence styles may influence many aspects of digital competency. Study population included all university students of District Lahore, and 600 students were selected randomly from this population. Quantitative research design was adopted for study in which standardized questionnaires were adopted for the study. Findings of study showed significant correlation amid specific intelligence styles & components of digital literacy, highlighting role of intrapersonal intelligence in communication, content creation, and safety within digital environments. Conversely, the verbal-linguistic intelligence shows limited correlation with digital literacy, stressing nuanced nature of intelligence-digital literacy associations. Furthermore, correlations reveal that content creation skills are associated with the intrapersonal intelligence & safety component, while the problem-solving was significantly linked to musical intelligence.

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INTRODUCTION

The study takes its roots from a remote theory of multiple intelligence (MI) proposed by Gardner, and tries to relate it with latest concept of digital literacy (DL). Gardner was first proponent of MI in different domains like language, calculation, spatial identification, body movements (called bodily kinesthetics), music, communication with each other (called interpersonal), self-care & actualization (intrapersonal intelligence) (Qasserras & Qasserras, 2023). These various intelligences enable the

individuals to process, understand, and express information in the diverse ways. As digital literacy become more prevalent in higher education, it is vital to recognize how it interact with these diverse types of intelligence to optimize learning outcome (Sitoy, Ndinga, Plaisent, Prosper & Peteros, 2021). Elçiçek and Üniversitesi (2022); Hoadley and Favaro (2018) described digital literacy play vital role in flourishing the students' linguistic, logical, and spatial intelligence. Maria, Lumbanbatu and Mayasari (2021a) explored impact of digital literacy on students' interpersonal and intrapersonal intelligences, revealing that digital tools can foster communication and self-awareness. The digital tools used in today age such as Google docs, or MS teams. enable learners to work in collaboration (UNESCO, 2023).

The use of digital platforms such as computer simulations also take students on the problem-solving skills (Khalil, Tairab, Qablan, Alarabi & Mansour, 2023), linguistic skills (Agussuryani, Sudarmin, Cahyono & Ellianawati, 2022), logical mathematical skills (Chidayati, Distrik & Abdurrahman, 2021). The logical mathematical skills are obtained by organizing and analyzing data (Abdulteeef & Khateeb, 2017). Digital literacy also contributes to development of students' spatial and bodily-kinesthetic intelligences (Mailman, 2012). Spatial intelligence involves skills to put mental images into visualization. While, on other hand, bodily kinesthetic refers to the ability to skillfully handle things manually & correct exhibition of body movements (Brazley, 2018a, 2018b). Sitoy et al. (2021b) found that incorporating digital literacy into curriculum significantly improved students' linguistic and logical-mathematical intelligences, highlighting the importance of integrating technology in education. Incorporating digital tools such as 3D modeling software, virtual reality, and augmented reality can help students enhance these intelligences. A study by Brazley (2018c), and Shaikh and Shamim (2011) verified that using virtual reality in architecture education significantly improved students' spatial intelligence. Similarly, incorporating digital tools in physical education classes can help students develop bodily-kinesthetic intelligence by providing feedback on their movements and techniques.

The digital literacy can also contribute to development of students' interpersonal and intrapersonal intelligences. As regard to interpersonal intelligence, it refers to the communication with others in best possible manner i.e., via speech, writing or body language. On the other hand, the interpersonal intelligence refers to self-awareness and understandings. This includes regulation of one's emotions & thoughts (Pilch, 2008; Zareen, Ali & Junjua, 2016). Digital platforms like social media, discussion forums, and online collaboration tools can facilitate better communication and collaboration amid students, enhancing interpersonal intelligence (Elçiçek & Üniversitesi, 2022b) & critical thinking skills that have been focused by diverse recent studies being a twenty first century skill (Jamil et al., 2024; Jamil, Bokhari, & Ahmad, 2024; Jamil, Bokhari, & Rafiq, 2024; Jamil & Muhammad, 2019; Jamil et al., 2021a, 2021b). Selwyn (2011) found that using social media in education improved students' interpersonal intelligence, while using the personal learning environments enhanced their intrapersonal intelligence. To further investigate linking amid MI and digital literacy, this article discusses examples of how these concepts impact students' learning experiences at university level. The study was made to explore the relationship between multiple intelligence and digital literacy of university students.

Research Questions

1. What is level of multiple intelligence among the university students?
2. What is the level of digital literacy among the university students?
3. What is relationship amid multiple intelligence & digital literacy of university students?

LITERATURE REVIEW

The technological revolution brought the abrupt changes in the educational system. The researches emphasized importance of digital literacy to integrate it into the curricula to foster different types of intelligences (Sitoy et al., 2021). Moreover, digital tools such as personal learning environments and reflective journals can help students develop their intrapersonal intelligence by encouraging self-reflection and analysis of their learning experiences. Therefore, for the higher education, it has become very necessary that they may enrich their students with essential digital literacy skills to flourish their students academically as well as practically. It also presents data from recent studies that demonstrate the effectiveness of integrating digital literacy into curriculum to cater to various types of intelligences.

Multiple Intelligences

According to American psychological association dictionary of psychology, intelligence is defined as "the factor which the ability to derive information, learn from experience, adapt to environment, understand, and correctly utilize thought and reason" (American Psychological Association, 2024). This concept of intelligence was further enhanced as its inclination into various fields. Thus, concept of Multiple Intelligence (MI) was proposed by Howard Garnder in 1980. In this theory, concept of intelligence was multi-furcated into linguistic, logical/mathematical, spatial, musical, kinesthetic, inter and intrapersonal (Qasserras & Qasserras, 2023). Understanding diversity of intelligences among university students can inform the teaching methods, curriculum design and student support services. Thus, by recognizing and nurturing these intelligences, educators create inclusive learning environments where all students have opportunity to thrive. Some researches relate MI & creativity i.e., persons with high IQ are creative and vice versa (Silvia, 2015). He asserted that nurturing the interpersonal and intrapersonal intelligence expand creative abilities among students which may lead to innovations.

On other hand, some researchers consider best utilization of the concept of MI in special education and for gifted students. Hence research made by Wangu (2014) asserted that MI based instruction brought very fruitful results in the reading comprehension of the students with learning disabilities., Mcclellan and Conti (2008) studied MI concept for gifted students and advised that understanding students' area of success (MI application) could be very active for educators to design more efficient curricula designs. This approach also led to the personalized learning based on students' unique MI profiles (Kahl et al., 2009). Perhaps many of these areas of intelligence like logical/mathematical, interpersonal and intrapersonal intelligence, meet concept of digital literacy. Thus, it is considered that digital literacy fosters MI. The study thus, was made to check this relationship. The researches indicated that digital tools and techniques and social media platforms connect students globally,

and broaden their exposure, thus, it enhances their learning experiences (Hoadley & Favaro, 2018; Sitoy, et al., 2021).

Digital Literacy in Higher Education

The digital literacy has become very necessary for higher education students to play their efficient in digitalized and globalized society. Ceylan (2020) found that incorporation of DL into curricula brought positive learning outcomes in language skills, PBL, creativity and visualization capability. The individuals with strong interpersonal intelligence are skilled at understanding and interacting with others. Studies explored that how DL could promote cooperation & interaction among students using social media. Irrespective to the negative effects of social media usage, increased interaction, cooperation and teamwork was observed which ultimately improved learning outcomes (Ghayas & Malik, 2013; He, Yan, Wang, Liao & Hu, 2023; Oman et al., 2013). The students strong in the intrapersonal intelligence have a deep understanding of themselves, their emotions & motivations. Thus, new research has investigated how digital literacy can promote cooperation and interaction among students.

Researchers investigated how university students use social media platforms to improve teamwork and learning outcomes through enhanced collaboration and communication (Fenesy & Lee, 2019; Li, Qiu & Sun, 2020; Sawyer, 2011). However, drawbacks of using digital platforms are unavoidable. Chang, Kim & Yoo (2020), and Brazley (2018a) enlisted such challenges which were being faced by the learners and educators themselves. These issues included digital divide, lack of digital skills, and inadequate infrastructures. Still, they agreed that overcoming these questions could guarantee best outcomes in higher education. The students with strong bodily-kinesthetic intelligence have excellent control over their bodies and are skilled in physical activities. Surge of pandemic and the people inclination to use blended learning also forced world toward digitalization (Díaz et al., 2020; Idris et al., 2021; Lim et al., 2022; OECD, 2020). Thus, demand of surge of digital skills for students & educators was multiplied.

Multiple Intelligences & Digital Literacy

The MI and DL relationship, as mentioned above, is become the point of collaborative concern and attention among researcher of recent years, particularly in context of higher education. Literature indicates that DL has significant impact on MI. Using the digital tools and technologies can polish students' abilities to efficiently navigate them for their academic success and for preparing them for the future lives(Abdulteeef & Khateeb, 2017; Helgevold & Moen, 2015). The studies also explored that the successive use of DL resulted in the enhancement of linguistic, mathematical and spatial intelligence areas (Hakan, Mehtap & Suleyman, 2017). Also, researches made by Jansen (2020), indicated significant relationship between DL and logical/ mathematical intelligence among the university students.

RESEARCH METHODOLOGY

The study employed a descriptive correlation survey with a quantitative approach to attain desired objectives. The researcher conducted a thorough review of relevant literature from books, articles, and online sources.

Population of Study

The study included five universities, comprising three public & two private institutions. Participants were assured about confidentiality of their responses. Research instruments included demographic details such as gender, age, institution name, field of study, academic level, year of study, current study mode (virtual or online), and students' living arrangements as well as research variables that are under study.

Sampling Technique

The data collection utilized purposive sampling, with participants divided into two groups: public university students and private university students. In this linking, random sampling was employed to gather the data from student hailing from the five universities, three of which were public and two were private.

Research Instrument

1. The demographic section comprising questions about students' age, gender, program of study, and educational institutions.
2. The tool to measure the digital literacy was adopted from Al-Khateeb (2017) "digital literacy competence survey".
3. The multiple intelligence was measured by MI questionnaire by Shahzada, Khan, Noor and Rahman (2014).

Validity & Reliability

The instrument was content validated by 20 experts. The item retention criteria were acceptance by 80% of experts. The face and construct validity of the research tool was also checked by pilot testing on 30 students initially. It was observed that complete research instrument took 15 minutes to be filled out. Thus, the wording of the instrument was also comprehendible for the students. The reliability of the research tool was assessed using Cronbach's alpha. It was found .72 and considered as satisfactory.

Ethical Considerations

All major research ethics were considered during data collection i.e., written brief note for informed consent was attached with questionnaire. The confidentiality of respondents' identities was strictly maintained so as to maintain their privacy regarding their values and views about their responses regarding diverse issues.

DATA ANALYSIS

The data analysis as obtained through different statistical procedures are presented in this section. The data analysis involved utilizing the mean and standard deviations (SD) technique to gauge the level of multiple intelligence and digital literacy/competency among university students. Pearson correlation, regression analysis, and ANOVA were employed to explore the relationships between variables. Thus, statistical computations were performed using SPSS software as well as smart PLS (partial least squares).

Table 1 Demographic Information of Data

Variable		Frequency	Percent
Gender	Male	50	83.3
	Female	250	16.7
Sector	Public	208	69.3
	Private	92	30.7
Age	Adolescence	4	1.3
	Young adulthood	296	98.7
Level of study	Year 1	27	9.0
	Year 2	82	27.3
	Year 3	112	37.7
	Year 4	76	25.3
	Year 5	3	1.0

This study examines a sample of 300 male and female students (N=300), with 50 (83.3%) being male and 250 (16.7%) females. Among, 208 (69.3%) attend public universities, while 92 (30.7%) attend private universities. Most students, 296 (98.7%), are in adolescence, with only 4 (1.3%) in the young adolescence. In this linking, regarding their academic year, 27 (9.0%) are in the year 1, 82 (27.3%) in year 2, 112 (37.7%) in year 3, 76 (25.3%) in year 4, and 3 (1.0%) in year 5 as evident from the results of current study.

Table 2 The Level of Multiple Intelligence among University Students

Intelligence Type	A	B	C
Bodily-Kinesthetic	59 (19.6%)	137 (45.7%)	104 (34.7%)
Existential	16 (5.4%)	160 (53.3%)	124 (41.3%)
Interpersonal	25 (8.3%)	158 (52.7%)	117 (39.0%)
Intrapersonal	12 (4.0%)	158 (52.7%)	130 (43.3%)
Logical-Mathematical	32(10.7%)	206 (68.7%)	62(20.7%)
Musical	13 (4.3%)	124 (41.4%)	163 (53.3%)
Naturalistic	15 (5.0%)	120 (40.0%)	165 (55.0%)
Verbal	12 (4.0%)	119 (39.7%)	169 (56.3%)
Visual	17 (5.7%)	101 (33.7%)	182 (60.7%)

Table 2 displays the characteristics of Multiple Intelligences (MI) of participants, where "A" denotes low strength, "B" denotes medium strength, "C" denotes high strength. Most respondents show low forte in bodily-kinesthetic intelligence, medium strength in logical-mathematical & high strength in visual intelligence.

Table 3 The level of digital literacy among university students

Indicators	Mean	Verbal Description
Information processing	6.0433	Digital expert
Communication	7.7333	Digital expert
Content creation	7.8833	Digital expert
Safety	8.0500	Digital expert
Problem-solving	7.8900	Digital expert

Table 3 indicates the students' proficiency in digital skills. As per Al-Khateeb (2017), scale ranges from 1.00 to 7.00, with the corresponding levels: the digitally illiterate/incompetent (1.00-1.86), very illiterate/incompetent (1.87-2.72), mildly illiterate/incompetent (2.73-3.58), literate/competent (3.59-4.44), moderately literate/competent (4.45-5.30), very literate/competent (5.31-6.16) & digital expert (6.17-7.00).

Table 4 Relationship between Multiple Intelligence & Digital Literacy/Competency

MI	Existential	Interpersonal	Intrapersonal	Logical
Bodily-kinesthetic	.369 (.000)	.095(.102)	.056 (.336)	-.106 (.066)
Existential		.075 (.195)	.088 (.129)	-.075 (.193)
Interpersonal			.118 (.041)	-.041 (.481)
Intrapersonal				.166 (.004)
Logical				
Naturalist				
Verbal				
Visual				
N=300				

Table 4A Relationship between Multiple Intelligence & Digital Literacy/Competency

MI	Musical	Naturalist	Verbal	Visual
Bodily-kinesthetic	.288 (.000)	.271 (.000)	.419 (.000)	.457 (.000)
Existential	.308 (.000)	.329 (.000)	-.395 (.000)	.510 (.000)
Interpersonal	.147 (.011)	.279 (.000)	-.430 (.000)	-.190 (.001)
Intrapersonal	-.267 (.000)	.207 (.000)	.186 (.001)	.251 (.000)
Logical	.058 (.313)	.135 (.020)	.354 (.000)	-.291 (.000)
Naturalist		-.116 (.045)	.008 (.896)	.082 (.165)
Verbal			.372 (.000)	.057 (.323)
Visual				.454 (.000)
N=300				

Table 4 and 4A displays Pearson product moment correlation coefficients representing relationship among different types of multiple intelligences. The results indicate a mix of positive and negative correlations, with 24 out of 36 associations being statistically significant. Positive and significant correlations were observed amid bodily-kinesthetic and existential (i.e., r=.369, p=0.01), bodily-kinesthetic, musical .288, (p=0.01), bodily-kinesthetic and naturalist (i.e., r=.271, p=0.01), bodily-kinesthetic, visual (r=.475, p=0.01), existential & musical (r=.308, p=0.01), existential and naturalist (r=.392, p=0.01), existential, visual (r=.510, p=0.01), interpersonal and intrapersonal (r=.118, p =0.01), intrapersonal, musical (r=.267, p =0.01), interpersonal and naturalist (r=.279, p =0.01), interpersonal and verbal (r=.430, p =0.01), intrapersonal and logical (r=.166, p =0.01), intrapersonal and naturalist (r=.207, p=0.01), intrapersonal and verbal (r=.186, p =0.01), intrapersonal and visual (r=.251, p =0.01), logical, naturalist (r = .135, p =0.01), logical and verbal (r=.354, p=0.01), naturalist and verbal (r =.372, p=0.01), verbal & visual (r=.454, p =0.01), support hypothesis. Equally, negative, correlation amid existential & verbal (r =-.395, p < 0.01), bodily-kinesthetic, verbal (r = -.419, p =0.01), interpersonal & visual (r= -.190, p =0.01), logical, visual (r = -.291, p =0.01), musical and naturalist (r=-.116, p =0.01) and do not support hypothesis.

Table 5 Correlation between the Different Components of Digital Literacy/Competency

DL	Communication	Content creation	Safety	Problem-solving
Information processing	.095 (.101)	.317 (.000)	.071 (.219)	.300 (.000)
Communication		.036 (.534)	.048 (.410)	-.018 (.757)
Content creation			.435 (.000)	.348 (.000)
Safety				.186 (.001)

The table 5 employed Pearson r Correlation Coefficient to investigate potential connections among all aspects of digital literacy/competency using a two-tailed test with a significance level of 0.01. All coefficient values indicated positive and significant correlations between the paired literacies. Specifically, there were the positive and significant correlations observed between the information processing and content creation (r = .317, p =0.01), information processing and problem-solving (r = .300, p =0.01), content creation and safety (r = .435, p =0.01), content creation and problem-solving (r = .348, p =0.01), and safety and problem-solving (r = .186, p =0.01). Consequently, the hypothesis is thus confirmed.

Table 6 Analysis of Differences amid Digital Literacy & Multiple Intelligence Style

	IP	COM	CC	SAF	PRS
Bodily-kinesthetic	0.287 (0.593)	3.234 (0.073)	0.609 (0.436)	0.083 (0.774)	0.138 (0.711)
Logic	1.066 (0.303)	2.255 (0.134)	0.089 (0.765)	0.194 (0.660)	0.023 (0.879)
Musical	0.500 (0.480)	2.494 (0.115)	0.203 (0.653)	0.297 (0.586)	0.016 (0.899)
Naturalistic	0.145 (0.70)	3.504 (0.035)	3.054 (0.04)	4.046 (0.010)	0.021 (0.885)
Verbal	0.509 (0.476)	0.929 (0.336)	0.038 (0.845)	0.032 (0.585)	0.001 (0.70)
Visual	0.542 (0.462)	2.890 (0.090)	0.207 (0.650)	0.217 (0.642)	0.066 (0.798)

Table 6 exhibits significant variations between multiple intelligences and digital literacy. Notably, there are differences in Content Creation skill among individuals with intrapersonal intelligence style (F=3.054, sig=0.04), as well as in the Safety component (F=4.046, sig=0.010). Moreover, those with a preference for "musical" intelligence may approach problem-solving differently. Given the limited number of significant associations—only three—these findings should be approached with caution. Moreover, students with musical inclinations have tendency to adopt creative problem-solving approaches.

DISCUSSION

This study was made on exploring relationship between multiple intelligence and digital literacy of university students. Nine aspects of multiple intelligences likewise bodily kinesthetics, existential, interpersonal, intrapersonal, logical & mathematical, musical, naturalistic, verbal, and visual were observed. While, five different types of digital literacy i.e., information processing, communication, content creation, safety and problem solving were observed in the study. First objective of the study was to measure level of multiple intelligence among university students. The findings of the study revealed that most of students had lower bodily kinesthetics, medium logical and mathematical, and high visual intelligence respectively. Literature indicated both in support and contrary results to findings of this study. As for example research made by Mailman (2012) indicated that usually

today students have lower bent towards bodily kinesthetics for which he used computer simulations to increase that skills. The contrary results with respect to mathematical/logical intelligence were observed, instead of medium level of logic, some researches categorized them at lowest level amid adolescents & young people (Hassan, et al., 2018; Chaudhry et al., 2013; Friborg et al., 2005). Some researches put visual intelligence at top position holding others behind (Hassan, et al., 2018; Mestre et al., 2006; Silvia, 2015).

The results variations may be due to the demographic differences among participants i.e., in present study there were more female students than males and competence or intelligence level obviously differ in the respective groups. Moreover, study groups in present research were more from public sector than that of private sector. While, the cited studies are mostly from western context where attitudes, and aptitudes of students are at a polar difference. So, effort was made to explore research metadata from eastern context as well. Zaman et al. (2023) revealed that the level of intelligence is contingent on learning process. He also asserted that demographic context is very strong moderator of multiple intelligence measurement. But, according to him, the females were more likely to have visual intelligence and males were more inclined to spatial intelligence factors. A latest study in Asian context was made by (Verma, 2024) where he asserted a different point of view. He declared that intelligence is not product of learning, rather it is predictor of learning process and learning styles. Second objective of study was to find out level of digital literacy amid university students. It was observed that students were most competent in safety, problem solving, content creation, and communication respectively.

While information processing was found to at one level low than expertise. The literature indicated variations in researches regarding digital literacy. Perhaps, it may be contingent on frequency of use of computers/digital media (Abdulteeef & Khateeb, 2017; Cartelli & Di Nuzzo, 2013; Elçiçek & Üniversitesi, 2022a, 2022b; Hoadley & Favaro, 2018). Third objective of the study was pinpoint of the research i.e., to explore relationship between digital literacy and multiple intelligence. In this case, significant associations were found among the content creation skills (DL), and intrapersonal intelligence (MI). An essay wrote by Parves (2024) indicated future of the digital literacy, indicated with evidences that the coming era of 2030 will be the era of the content creation, and interpersonal intelligences. However, he ignored to write about interpersonal intelligence. On the other hand, Lei et al. (2021) asserted that multiple intelligence, especially intrapersonal intelligence is respectable precursor or learning achievement and motivation. Similarly, the study findings revealed a decent positive association between Problem solving skills (DL) and musical intelligence (MI). Study made by (Maria et al. 2021b) further supported this finding as it is irrespective to the frame of research in western context. Consequently, it can be more firmly stated that creativity and musical intelligence are thus correlated.

However, the research made on "Impact of Design Thinking Model on Fifth Graders" indicated that the creativity is not only contingent on the musical intelligence, rather more of creativity depends upon the visualization and intrapersonal intelligences (He et al., 2023). Findings of the study also declared intrapersonal intelligence, particularly in relation to communication, content creation, & safety components, exhibited the most common correlations with digital literacy. These results were

supported by various researches as well (Antonenko & Thompson, 2011; Glăveanu, 2011; Ng et al., 2021; Rosiña et al., 2020). As for example research made by Mailman (2012) indicated that usually today students have lower tendency toward bodily kinesthetics for which used computer imitations to increase that skills. Gender and specialization were considered as pre-requisites of the multiple intelligence factors estimates (Hassan, et al., 2018). A review on digital literacy meta data indicated that today students have good comprehension of digital world and this is good sign for educators to go smooth on learning process ahead (Tinmaz et al., 2022). This alignment is reasonable, as digital work involves solitary tasks, allowing individuals to reflect on their personal thoughts, experiences, and behaviors online.

CONCLUSION

The study at first reveals a valuable insight to current situation of multiple intelligence and digital literacy levels of the Pakistani university students. Afterwards highlighting the importance of DL in enhancement of MI is also explored in study. As regard to level of multiple intelligence of students, visual intelligence tendency of students is observed at peak, preceding with the bodily kinesthetics and logical mathematical intelligence. On other hand, with respect to digital literacy, the students were observed at expertise level at all types of the digital literacies. However, while observing the association between both variables, it was observed that musical intelligence had good association with the creative problem-solving skills, followed by intrapersonal, and interpersonal intelligence associated with the content creation, and safety components respectively. However, coinciding the findings with literature indicated that there is not hard and fast rule for such findings. But, in this context digital literacy can enhance communication (interpersonal intelligence), self-actualization (intrapersonal intelligence), knowing greater about whereabouts of things (spatial intelligence) and logical intelligence.

Recommendations

1. Broadening the research area from Lahore, Punjab to overall Pakistan and finding deprived area students' competencies can give a very precious insight to the situation
2. The research was made in quantitative design only. Adding touch of qualitative work can exhibit students' perception and detailed picture of issues while this discourse.
3. Implementing the experimental interventions to assess the effectiveness of specific teaching strategies or digital literacy interventions in enhancing MI profiles.

REFERENCES

Abdelkarim, R., Hassan, K., & Abuiyada, R. (2018). How Students' Multiple Intelligences Differ in Terms of College and Gender. *International Journal of Business and Social Science*, 9(5).

Abdelkarim, R., Hassan, K. A., & Abuiyada, R. (2018). Gender and Specialization Differences of Business Students in Self -Estimates of Multiple Intelligences. *Journal of Education & Social Policy*, 5(2).

Abdulteeef, A., & Khateeb, M. (2017). Measuring the Digital Competence and ICT Literacy: An Exploratory Study of In-Service English Language Teachers in the Context of Saudi Arabia. *International Education Studies*, 10(12), 38–51.

Agussuryani, Q., Sudarmin, S., Sumarni, W., Cahyono, E., & Ellianawati, E. (2022). STEM literacy in growing vocational school student HOTS in science learning: A meta-analysis. *International Journal of Evaluation and Research in Education*, 11(1), 51–60.

American Psychological Association. (2024). Intelligence. American Psychological Association Dictionary of Psychology.

Antonenko, P. D., & Thompson, A. D. (2011). Preservice teachers' perspectives on the definition and assessment of creativity and role of web design in developing creative potential. *Education and Information Technologies*, 16(2), 203–224.

Baer, J., Kaufman, J. C., & Gentile, C. A. (2004). Extension of the Consensual Assessment Technique to Nonparallel Creative Products. *Creativity Research Journal*, 16(1), 113–117.

Cartelli, A., & Di Nuzzo, A. (2013). Digital Literacy and Competence in Students Attending a Faculty of Humanities. In Fostering 21st Century Digital Literacy and Technical Competency (1st ed., Vol. 1, pp. 55–64). IGI Global.

Ceylan, S. (2020). Using Virtual Reality to Improve Visual Recognition Skills of First Year Architecture Students: A Comparative Study. CSEDU 2020 - Proceedings of the 12th International Conference on Computer Supported Education, 2, 54–63.

Chang, E., Kim, H. T., & Yoo, B. (2020). The Virtual Reality Sickness: A Review of Causes and Measurements. *International Journal of Human-Computer Interaction*, 36(17), 1658–1682.

Chaudhry, A., Jan, A., Sajjad, M., & Ali, S. (2013). Emotional intelligence and students: A Pakistani perspective. *World Applied Sciences Journal*, 22(3), 319–325.

Chidayati, N., Distrik, I. W., & Abdurrahman, A. (2021). Improving Students' Higher Order Thinking Skill with STEM-Oriented E-Module. *Indonesian Journal of Science and Mathematics Education*, 4(3), 274–286.

Duwain Brazley, M. (2018a). Architecture, Virtual Reality, Spatial Visualization, Learning Styles, & Distance Education. *International Journal of Architecture, Arts and Applications*, 4(2), 10.

Duwain Brazley, M. (2018b). Architecture, Virtual Reality, Spatial Visualization, Learning Styles, & Distance Education. *International Journal of Architecture, Arts and Applications*, 4(2), 10.

Duwain, M. (2018c). Architecture, Virtual Reality, Spatial Visualization, Learning Styles, and Distance Education. *International Journal of Architecture, Arts and Applications*, 4(2), 10.

Elçiçek, M., & Üniversitesi, S. (2022a). Postgraduate Theses on Digital Literacy in Turkey: A Content Analysis Study. https://dergipark.org.tr/en/pub/joltida.

Elçiçek, M., & Üniversitesi, S. (2022b). Postgraduate Theses on Digital Literacy in Turkey: A Content Analysis Study. https://dergipark.org.tr/en/pub/joltida.

Espino-Díaz, L., Fernandez-Caminero, G., Hernandez-Lloret, C. M., Gonzalez-Gonzalez, H., & Alvarez-Castillo, J. L. (2020). Analyzing impact of COVID-19 on education professionals. Toward a paradigm shift: ICT and neuroeducation as a binomial of action. *Sustainability*, 12(14), 1–10.

Fenesy, M. C., & Lee, S. S. (2019). Executive Funtioning Mediates Predictions of Youth Academic & Social Development from Parenting Behavior. *Physiology & Behavior*, 43(8), 729–750.

Friborg, O., Barlaug, D., Martinussen, M., Rosenvinge, J. H., & Hjemdal, O. (2005). Resilience in relation to personality and intelligence. *International Journal of Methods in Psychiatric Research*, 14(1), 29–42.

Ghayas, S., & Malik, F. (2013). Sociability and Academic Achievement as Predictors of Creativity Level among University Students. *Journal of the Indian Academy of Applied Psychology*, 39(2), 266–273.

Glăveanu, V. P. (2011). Creating Creativity: Reflections from Fieldwork. *Integrative Psychological and Behavioral Science*, 45(1), 100–115.

Hakan, K., Mehtap, B., & Suleyman, C. (2017). A Study on the Relationship between Problem Solving Skills and Multiple Intelligences of High School Students. *International Journal of Education and Practice*, 5(10), 171–181.

He, W., Yan, J., Wang, C., Liao, L., & Hu, X. (2023). Exploring the Impact of the Design Thinking Model on Fifth Graders' Creative Self-Efficacy, Situational Interest, and Individual Interest in STEM Education. *Thinking Skills and Creativity*, 50.

Helgevold, N., & Moen, V. (2015). The use of flipped classrooms to stimulate students' participation in academic course in initial teacher education. *Nordic Journal of Digital Literacy*, (1).

Hoadley, C., & Favaro, S. (2018). Digital Literacy in Higher Education. https://doi.org/10.4135/8781483346397.n97.

Idris, F., Zulkipli, I. N., Abdul-Mumin, K. H., Ahmad, S. R., Mitha, S., Rahman, H. A., Rajabalaya, R., David, S. R., & Naing, L. (2021). Academic experiences, physical and mental health impact of COVID-19 pandemic on students and lecturers in health care education. *BMC Medical Education*, 21(1), 1–13.

Jamil, M., & Muhammad, Y. (2019). Teaching science students to think critically: Understanding secondary school teachers' practices. *Journal of Research & Reflections in Education (JRRE)*, 13(2), 256-272.

Jamil, M., Anwar, M., & Ali, J. (2024). Developing critical thinking skills in english classrooms at the secondary level: Teachers' perspective. *Journal of Social Sciences Development*, 3(1), 76-85.

Jamil, M., Bokhari, T. B., & Ahmad, D. (2024). Evaluation of Critical Thinking Elements: A Qualitative Content Analysis of Physics Textbook Grade IX. *Qlantic Journal of Social Sciences*, 5(1), 344-350.

Jamil, M., Bokhari, T. B., & Rafiq, M. (2024). Critical thinking skills development for 21st century: An analysis of Biology curriculum (2006). *Voyage Journal of Educational Studies*, 4(1), 127-138.

Jamil, M., Muhammad, Y., & Qureshi, N. (2021a). Critical thinking skills development: Secondary school science teachers' perceptions and practices. *Sir Syed Journal of Education & Social Research (SJESR)*, 4(2), 21-30.

Jamil, M., Muhammad, Y., & Qureshi, N. (2021b). Secondary school science teachers' practices for the development of critical thinking skills: An observational study. *Journal of Development and Social Sciences*, 2(4), 259-258.

Jane Wangu, M. (2014). The Impact of Gender Difference on Student's Academic Performance in Secondary Schools in Ndumeri Division, Kiambu County, Kenya in Science Subjects and Language [University of Nairobi].

Jansen, C. J. (2020). Exploring Attitudes towards Augmented or Virtual Reality for Biology and Mathematics Teachers in Dutch Secondary Education [Utrecht University]. https://dspace.library.uu.nl/handle/1874/397610.

Kahl, C. H., Fonseca, H., & Witte, E. H. (2009). Revisiting Creativity Research: An Investigation of Contemporary Approaches. *Creativity Research Journal*, 21(1), 1–5.

Keleman, M., Rasul, S., & Jalaludin, N. A. (n.d.). Assessment of Higher Order Thinking Skills Through Stem Integration Project-Based Learning for Elementary Level. *International Journal of Social Science and Human Research*. https://doi.org/10.47191/ijsshr/v4-i4-40.

Khalil, R. Y., Tairab, H., Qablan, A., Alarabi, K., & Mansour, Y. (2023). STEM-Based Curriculum and Creative Thinking in High School Students. *Education Sciences*, 13(12).

Lei, D. Y., Cheng, J. H., Chen, C. M., Huang, K. P., & James Chou, C. (2021). Discussion of Teaching with Multiple Intelligences to Corporate Employees' Learning Achievement and Learning Motivation. *Frontiers in Psychology*, 12.

Li, Y., Qiu, L., & Sun, B. (2020). School engagement as a mediator in students' social relationships and academic performance: a survey based on Cite Space. *International Journal of Crowd Science*, 1(1), 2398–7294.

Lim, L. T. S., Regencia, G., Dela Cruz, C., Ho, V., Rodolfo, S., Uson, J., & Baja, E. S. (2022). Assessing the effect of COVID-19 pandemic, shift to online learning, and social media use on the mental health of college students in the Philippines: A mixed-method study protocol. *PLoS ONE*, 17, 1–13.

Mailman, J. B. (2012). Interactive Computer Simulation for Kinesthetic Learning to Perceive Unconventional Emergent Form-bearing Qualities in Music by Crawford Seeger, Carter, Ligeti, and Others. Proceedings of the 12th International Conference on Music Perception and Cognition and the 8th Triennal Conference of European Society for Cognitive Sciences of Music, July 23-28, 2012, Thessaloniki, Greece, 1925, 644–650.

Maria, I., Lumbanbatu, F., & Mayasari, D. (2021a). Digital Literacy based on Multiple Intelligences Integrated with 4C (Critical, Creative, Collaborative and Communication) to Improve Students Learning Outcome.

Maria, I., Lumbanbatu, F., & Mayasari, D. (2021b). Digital Literacy based on Multiple Intelligences Integrated with 4C (Critical, Creative, Collaborative and Communication) to Improve Students Learning Outcome.

Mcclellan, J. A., & Conti, G. J. (2008). Identifying the Multiple Intelligences of Your Students. *Journal of Adult Education*, 37(1), 13–35.

Mestre, J. M., Guil, R., Lopes, P. N., Salovey, P., & Gil-olarte, P. (2006). Emotional intelligence and social and academic adaptation to school. *Psicothema*, 18, 112–117.

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, 2.

OECD. (2020). Strengthening online learning when schools are closed – The role of families and teachers in supporting students during COVID-19 crisis. https://read.oecd-ilibrary.org/view/?ref=136_136615-o13x4bkowa&titleStrengthening-online-learning-when-schools-are-closed.

Oman, S. K., Tumer, I. Y., Wood, K., & Seepersad, C. (2013). A comparison of creativity and innovation metrics and sample validation through in-class design projects. *Research in Engineering Design*, 24(1), 65–92. Parves, S. (2024, January 1). The Future of Digital Literacy. SP Cloud Academy.

Pilch, I. (2008). Machiavellianism, emotional intelligence and social competence. *The Polish Psychological Bulletin*, 39(3), 158–164.

Qasserras, L., & Qasserras, M. (2023). Gardner's Theory's Impact on English Language Teaching: A Constructive Analysis. *European Modern Studies Journal*, 7(1), 340–347.

Rosiña, E., Bermejo, M. L., Barco, M., Cañada, F., & Sanchez-Martin, J. (2020). Multiple Intelligences Analysis Emotional Implications in STEM Education for Students up to K-12. In University of Extremadura (Ed.), Examining Multiple Intelligences and Digital Technologies for Enhanced Learning Opportunities (1st ed., Vol. 1, pp. 1–20). IGI Global.

Sawyer, R. (2011). The Impact of New social media on Intercultural Adaptation. Digital Commons, 5, 1–30. https://doi.org/10.1111/j.1548-1379.2010.01107.x.

Selwyn, N. (2011). "It's All about Standardisation" Exploring the Digital (Re)Configuration of School Management and Administration. *Cambridge Journal of Education*, 41(4), 473–488.

Shahzada, G., Khan, U. A., Noor, A., & Rahman, S. (2014). Self-Estimated Multiple Intelligences of Urban & Rural Students. 8(2), 116–124.

Silvia, P. J. (2015). Intelligence and Creativity Are Pretty Similar After All. *Educational Psychology Review*, 27(4), 599–606.

Sitoy, R. E., Ndinga, P., Plaisent, M., Posper, B., & Peteros, E. D. (2021). Intelligence Style and Digital Literacy. *IBIMA Business Review*, 2021(1), 1–17.

Sitoy, R. E., Ndinga, P., Plaisent, M., Prosper, B., & Peteros, E. D. (2021). Intelligence Style and Digital Literacy. *Journal of E-Learning and Higher Education*, 2021(1), 1–19.

Sitoy, R. E., Ndinga, P., Plaisent, M., Prosper, B., & Peteros, E. D. (2021b). Intelligence style and digital literacy. *IBIMA Business Review*, 2021.

Tinmaz, H., Lee, Y. T., Fanea-Ivanovici, M., & Baber, H. (2022). A systematic review on digital literacy. *Smart Learning Environments*, 9(1).

UNESCO. (2023). Global Education Monitoring Report, 2023: Technology in Education: A Tool on Whose Terms? (Vol. 1). UNESCO.

Verma, Y. (2024, March 28). Understanding learning styles via Gardner's Theory of Multiple Intelligences.

Zaman, A., Scholar, P., & Khan, A. W. (2023). Effects Of Multiple Intelligence-Based Teaching on Enhancing Science Literacy Concepts. *In International Journal of Literacy Theory and Practice* (Vol. 1).

Zareen, S., Ali, A., & Junjua, M. A. (2016). Usage of Social Networking Sites: Interpersonal Communication Motives of Youth. *Arts and Social Sciences Journal*, 05(02).