

ESTABLISHING RELIABILITY AND VALIDITY OF AN INSTRUMENT TO MEASURE DIGITAL LITERACY PRACTICES AND PERCEPTIONS IN HIGHER EDUCATION

B. Braktia¹, L. E. Haas¹, A. M. Montenegro Sanchez², A. V. Koptelov¹

¹ Sam Houston State University
Huntsville, TX 77341, United States

² University of Costa Rica
San Pedro Montes de Oca, San José, 11501, The Republic of Costa Rica

Abstract

The purpose of this study was to develop a reliable and valid instrument to explore the perceptions and practices of university professors and instructors with regards to digital literacy practices in the field of education. The Exploratory Factor Analysis (EFA) revealed four factors with eigenvalues greater than one. The 20-item instrument explained 65.08 % of the variance in relationship patterns among items: 36.49 % — F1: “Digital literacies help me teach”, 11.02 % — F2: “I have digital literacy competency and resources”, 8.99 % — F3: “Digital literacies support student learning”, and 8.58 % — F4: “Students are competent with digital literacy”. The instrument was deemed as reliable in determining faculty perceptions and practices.

Keywords: higher education, digital literacy, perception, survey tools, reliability, validity, practices.

DOI: 10.32517/0234-0453-2021-36-1-33-37

For citation:

Braktia B., Haas L. E., Montenegro Sanchez A. M., Koptelov A. V. Establishing reliability and validity of an instrument to measure digital literacy practices and perceptions in higher education. *Informatika i obrazovanie — Informatics and Education*, 2021, no. 1, p. 33–37.

Received: October 30, 2020.

Accepted: November 24, 2020.

About the authors

Bahia Braktia, Ed.D., Research Assistant at the Department of Educational Leadership, Sam Houston State University, Texas, United States; bxb039@shsu.edu; ORCID: 0000-0001-6498-6997

Lory E. Haas, Ed.D., Assistant Professor, Coordinator, Field II Experience & Undergraduate Reading Program, School of Teaching and Learning, College of Education, Sam Houston State University, Texas, United States; leh015@shsu.edu; ORCID: 0000-0001-6831-8451

Ana Marcela Montenegro Sanchez, Ed.D., Professor at the Department of Modern Languages, University of Costa Rica, San José, The Republic of Costa Rica; amm179@shsu.edu; ORCID: 0000-0001-9706-1157

Andrey V. Koptelov, Ph.D., Associate Professor, Director of the Center for International Education, School of Teaching and Learning, College of Education, Sam Houston State University, Texas, United States; axk022@shsu.edu; ORCID: 0000-0003-3590-8804

1. Introduction

Teachers' and learners' attitude toward digital literacy practices and E-learning have been determined as critical to the technology use success [1, 2]. According to Carter et al. [3], teachers' perceptions and beliefs toward the use of technology in a classroom setting play a major role in the extent to which they will incorporate Information and Communication Technologies (ICTs) in their classrooms and give their students the chance to engage with technology. Kowalczyk-Walędziak, Korzeniecka-Bondar, Danilewicz, & Lauwers [4] reveal challenges in the teaching profession with regard to digital literacy practices are due to lack of effective pre-service and inservice training that not only impact teachers, but ultimately the learning outcomes of their students. Therefore, it is imperative teachers have appropriate professional development opportunities in the use of ICTs to better prepare students educationally and connect with their world outside of the educational setting. Goodfellow [5]

expressed the scarcity of research on digital literacy practices in higher education: “despite a large literature on various pedagogical issues to do with the use of new media in teaching and learning in Higher Education, there are only two titles to be found which specifically address *digital literacy*” [5]. Dziuban, Graham, Moskal, Norberg, and Sicilia [6] explain that the increase in a blended model of course delivery, which combines face-to-face and online formats, has increased the need for higher education faculty to become adept in technology and learn to apply ICTs in their teaching. Koumachi [7] shared that the digitized generation has its own learning preferences, along with beliefs about how learning in such an era is cause for higher education faculty to revisit their curricula. Further, Koumachi noted the disparity between digital natives and digital immigrants is most evident in academic life. With the need to address digitalization in education, especially higher education, there is little empirical research has been published on the general digital literacy practices of faculty in the classroom (Lewis et al. [8]); hence, the

purpose of this study was to develop a reliable and valid instrument to explore the perceptions and practices of university professors and instructors with regards to digital literacy practices in the field of education. The following research questions guided this investigation:

1. What set of items should be included in the final instrument based on analyses of the developed survey to appropriately determine the practices and perceptions of higher education faculty regarding use of digital literacies as teaching and learning tools in their courses?
2. What factors or themes emerge based on responses to the set of items on the final instrument?
3. What is the validity and reliability of the instrument in determining the digital literacy practices and perceptions of faculty in higher education to support teaching and learning?

2. Theoretical Framework

Many models and theories are identified to assess the usage of technology tools and their adoption. The Unified Theory of Acceptance and Use of Technology (UTAUT) model, developed by Venkatesh, Morris, Davis, and Davis [9], is adopted and extended to examine faculty's behavioral intention to incorporate technology in their courses (see Koral Gümüsoğlu & Akay [10]; Lewis et al. [8]; Liebenberg et al. [11]). Wedlock and Trahan [12] revisited the model from a historic perspective to show how it could be used to examine current technology as it continues to evolve. Venkatesh, et al. [9] put together eight similar technology acceptance models to create a unified model that includes four constructs:

1. Performance expectancy: the degree to which educators believe that using technology will help them advance in job performance.
2. Effort expectancy: the degree of comfort associated with the use of technology.
3. Social influence: the degree to which educators perceive that others believe they have to use technology.
4. Facilitating conditions: the degree to which educators believe that organizational and technical infrastructure exists to support the use of technology.

Additionally, Venkatesh et al. [9] set gender, age, experience, and voluntariness of use as moderators.

3. Literature Review

In the context of learning in a digital age, there is an assumption that students coming into universities are raised in a universal and uniform digital environment and have an advanced knowledge and understanding of ICTs (Koumachi [7], Prensky [13, 14]). However, similar assumptions threaten to overlook a more complex mix of digital technologies-based skills, knowledge and preferences among the students. According to Skok [15] and Koumachi [7] digital natives' unique abilities, skills, and educational preferences stem from generational

contexts. This includes the need for individualized learning, opportunities to multitask, use of devices to access content, collaboration, and the desire for immediate reinforcement and feedback. Skok [15] further purports the educational shift in ICTs in education is based on the current generation's demands and expectations versus adapting to the changing world. Additionally, the digital age drives faculty "to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources to construct new knowledge, and empower students with essential skills, competencies, and knowledge for success in the workplace" (Mishra [16]). Equally, being able to effectively navigate and utilize digital resources is necessary to function in a society highly digitized where the information is at our fingertips.

Kennedy et al. [17] conducted a study to report the degree to which incoming first year students ($N = 2120$) at a large Australian metropolitan university access and use an array of technologies and technology-based tools. They also sought to determine the degree to which students reported their desire to use particular technologies to assist their learning process in a higher education setting. A four-page questionnaire was designed to learn more about students' access to, use of, skills with, and preferences for an array of established and emerging technologies and technology-based tools. The results revealed many first-year students are highly tech-savvy. However, when looking further than entrenched technologies and tools (computers, mobile phones, email, etc.), the patterns of access and use of a range of other technologies show considerable variation (Kennedy et al. [17]).

Kukulska-Hulme [18] investigated methods for educational professional development at the Open University, The United Kingdom, including the new approaches adopted toward mobile learning. Researchers examined the outcomes of these learning experiences and presented a lifelong learning perspective which can help the higher education workforce to evolve. Findings showed that academic staff showed interest in mobile learning; however, they were discouraged by the perceived amount of time and effort required to invest in understanding mobile learning. The researcher concluded that faculty need to recognize they are professional role models to their students and adopt a lifelong learning stance and embrace the opportunity to combine research and inquiry with teaching and learning (Kukulska-Hulme [18]).

Osakwe et al. [2] explored the perception of teachers and learners on the adoption of mobile learning in a Namibian high school. Using a mixed methods design, they administered a survey and conducted interviews with teachers and learners. The findings revealed the majority of the participants are mobile ICT literate. Both teachers and learners held a positive attitude toward mobile technology and believed it would increase their teaching and learning capacities, help improve learner grades, and facilitate teaching and learning activities. Nevertheless, the participants consider the policymakers are responsible for the adoption of mobile technology in schools (Osakwe et al. [2]).

Lewis et al. [8] utilized the UTAUT model to explore the incorporation of established and emerging technologies in higher education classrooms. The researchers used an online survey to collect data from full-time business faculty members ($N = 46$) teaching face-to-face at a southeastern university in the United States. They analyzed the context of instructors' use of technology within the constructs of the UTAUT model. Their results revealed that the most important antecedents are performance expectancy, effort expectancy, social influence, and habit with more complex effects when gender is added as an interaction term.

Koral Gümüsoğlu and Akay [10] examined the technology acceptance level of teachers at Anadolu University School of Foreign Languages using the UTAUT model. A survey was distributed to university lecturers ($N = 44$) who were using technology in their courses to measure their acceptance and attitudes towards technology. Results showed the overall technology acceptance level of the participants is above average.

Mishra [16] conducted a study with faculty and staff from Sambalpur University in India to explore faculty perspectives and perceptions regarding the digital information literacy resources and their skills and competencies managing the digital information. The role of libraries at a higher level is crucial to inform and assist faculty to look for digital information to incorporate it in their teaching practices effectively. To explore the relationship between the digital information literacy and digital literacy skills among faculty members, a questionnaire with close-and open-ended questions was administered among ($N = 102$) faculty from various departments of SU obtaining a 68.6 % of response rate. A Likert scale was employed to obtain faculty perceptions and attitudes toward the use of digital resources. The data analysis consisted in descriptive statistics.

The results of the study revealed that faculty members considered that digital skills and digital information literacy is crucial for the digital era. Additionally, the use of the digital information and resources is relevant for faculty's teaching practice; however, librarians should provide innovative practices to support faculty's digital skills development. Furthermore, faculty's perceptions regarding their digital skills was positive. They were competent and knowledgeable when utilizing different digital tools. Nonetheless, it is necessary that the U.S. provides training to librarians to better assist faculty to employ digital tools in their research, and teaching and learning process.

4. Methods and Procedures

4.1. Research Context

A survey instrument was developed using an institution-based Qualtrics online survey software. Part one of the survey consists of collecting demographic information (age, gender, teaching experience, institution, faculty ranking, etc.). Part two is constructed of likert scale (1–5) questions with anchors

ranging from “strongly disagree” to “strongly agree”. The survey was administered to faculty in the college of education at a university in Southeast Texas via email. Responses from the demographic and likert-scale questions were downloaded from the Qualtrics software into an Excel file then data were uploaded and analysed using the latest version of a statistical software package called Statistical Package for the Social Sciences (SPSS).

4.2. Participants

In the fall of 2018, a total of 60 faculty members participated in this study with expertise in a wide range teaching fields: elementary and secondary teacher education programs, bilingual education, special education, early childhood education, counseling, literacy, and educational leadership. Respondents were full professor (12), associate professor (12), assistant professor (16), clinical (12), and part-time instructor (8).

4.3. Data Analyses

Initially, an Exploratory Factor Analysis (EFA) was conducted to determine eigenvalues of potential factors. Next the Kaiser—Meyer—Olkin (KMO) Measure of Sampling Adequacy (KMO) test was executed to verify the size of sampling was adequate, along with Bartlett's Test of Sphericity to determine construct validity and if correlations between survey items were sufficiently large to conduct EFA. In order to conduct EFA, Bartlett's Test of Sphericity should indicate statistical significance of less than .05. The Kaiser—Meyer—Olkin Measure verified the sampling adequacy for the analysis, $KMO = .757$ which is above Kaiser's recommendation of a 0.6 threshold (Kaiser [19]). In addition, Bartlett's test of sphericity revealed strong correlations among items for factor analysis, $\chi^2(210) = 760.09$, $p < .000$. An EFA was then conducted to determine factor structures of the Digital Literacy Practices and Perceptions in Higher Education (DLPPHE) instrument.

5. Results

Descriptive statistics were analyzed for all 22-items in the initial survey. Two items revealed a mean score of 1.34 and 1.48, whereas the mean for the other 20-items ranged from 3.48–4.65. Cronbach's α was conducted for the 22-items survey which indicated .89 for internal consistency, when delting to 2 items with the lower mean score Cronbach's α increased to .91 for the overall survey. The EFA revealed four factors with eigenvalues greater than one. The 20-item instrument explained 65.08 % of the variance in relationship patterns among items: 36.49 % — F1: “Digital literacies help me teach”, 11.02 % — F2: “I have digital literacy competency and resources”, 8.99 % — F3: “Digital literacies support student learning”, and 8.58 % — F4: “Students are competent with digital literacy”. Internal consistency of the four factors were analyzed which revealed Cronbach's α for each factor were .88, .86, .83, and .81, respectively. Factor loadings ranged from .824–.857 for factor one, .733–.834 for factor two, .615–.733 for factor three, and .524–.689 for factor four.

6. Conclusions

The factor analysis revealed four factor structures of DLPPHE revealed high reliability of the instrument. The final 20-item survey included 6 items for F1: “Digital literacies help me teach”, 5 items for F2: “I have digital literacy competency and resources”, 5 items for F3: “Digital literacies support student learning”, and 4 items for F4: “Students are competent with digital literacy”. Although the instrument was deemed as reliable in determining faculty perceptions and practices, there are limitations to consider including whether faculty taught online courses, face-to-face courses, or a combination. In addition, a larger sampling may be used in the future, as well as exploring faculty in other disciplines in higher education.

References

1. Bhuasiri W., Xaymoungkhoun O., Zo H., Rho J. J., Ciganek A. P. Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty. *Computers & Education*, 2012, vol. 58, is. 2, p. 843–855. DOI: 10.1016/j.compedu.2011.10.010
2. Osakwe J., Dlodlo N., Jere N. Where learners' and teachers' perceptions on mobile learning meet: A case of Namibian secondary schools in the Khomas region. *Technology in Society*, 2017, vol. 49, p. 16–30. DOI: 10.1016/j.techsoc.2016.12.004
3. Carter A., Cotton S. R., Gibson P., O'Neal L. J., Simoni Z., Stringer K., Watkins L. S. Integrating computing across the curriculum: Incorporating technology into STEM education. *Transforming K-12 classrooms with digital technology*. IGI Global, 2014, p. 165–192. DOI: 10.4018/978-1-4666-4538-7.ch009
4. Kowalczyk-Walędziak M., Korzeniecka-Bondar A., Danilewicz W., Lauwers G. A time for reflection and dialogue: How do we educate teachers to meet the challenges of the 21st century? *Rethinking teacher education for the 21st century: Trends, challenges and new directions*. Berlin, Verlag Barbara Budrich, 2019, p. 15–24. DOI: 10.2307/j.ctvpb3xhh.5
5. Goodfellow R. Literacy, literacies and the digital in higher education. *Teaching in Higher Education*, 2011, vol. 16, is. 1, p. 131–144. DOI: 10.1080/13562517.2011.544125
6. Dziuban C., Graham C. R., Moskal P. D., Norberg A., Sicilia N. Blended learning: the new normal and emerging technologies. *International Journal of Educational Technology in Higher Education*, 2018, vol. 15, is. 1, p. 1–16. DOI: 10.1186/s41239-017-0087-5
7. Koumachi B. The digital turn in higher education: “Digital natives” mythbusted. *International Journal of Technology in Education and Science*, 2019, vol. 3, no. 1, p. 56–62. Available at: <https://www.ijtes.net/index.php/ijtes/article/view/16>
8. Lewis C. C., Fretwell C. E., Ryan J., Parham J. B. Faculty use of established and emerging technologies in higher education: A unified theory of acceptance and use of technology perspective. *International Journal of Higher Education*, 2013, vol. 2, no. 22, p. 22–34. DOI: 10.5430/ijhe.v2n2p22
9. Venkatesh V., Morris M. G., Davis G. B., Davis F. D. User acceptance of information technology: Toward a unified view. *Management Information Systems Research Center*, 2003, vol. 27, no. 3, p. 425–478. DOI: 10.2307/30036540
10. Koral Gümüşoğlu E., Akay E. Measuring technology acceptance level of teachers by using unified theory of acceptance and use of technology. *International Journal of Languages' Education and Teaching*, 2017, vol. 5, is. 4, p. 378–394. DOI: 10.18298/ijlet.2239
11. Liebenberg J., Benade T., Ellis S. Acceptance of ICT: Applicability of the Unified Theory of Acceptance and Use of Technology (UTAUT) to South African students. *The African Journal of Information Systems*, 2018, vol. 10, is. 3, article 1. Available at: <https://digitalcommons.kennesaw.edu/ajis/vol10/iss3/1>
12. Wedlock B. C., Trahan M. P. Revisiting the Unified Theory of Acceptance and the Use of Technology (UTAUT) model and scale: An empirical evolution of educational technology. *Research Issues in Contemporary Education*, 2019, vol. 4, no. 1, p. 6–20. Available at: <https://eric.ed.gov/?id=EJ1244613>
13. Prensky M. Digital natives, digital immigrants, part 1. *On the Horizon*, 2001, vol. 9, no. 5, p. 3–6. DOI: 10.1108/10748120110424816
14. Prensky M. Digital natives, digital immigrants, part 2: Do they really think differently? *On the Horizon*, 2001, vol. 9, no. 6, p. 1–6. DOI: 10.1108/10748120110424843
15. Skok K. No Teacher without a Student... A theoretical analysis and practical implications of educational changes in the era of digital natives. *Rethinking teacher education for the 21st century: Trends, challenges and new directions*. Berlin, Verlag Barbara Budrich, 2019, p. 15–24. DOI: 10.2307/j.ctvpb3xhh.11
16. Mishra C. Faculty perceptions of Digital Information Literacy (DIL) at an Indian university: An exploratory study. *New Review of Academic Librarianship*, 2019, vol. 25, is. 1, p. 76–94. DOI: 10.1080/13614533.2018.1517102
17. Kennedy G. E., Judd T. S., Churchward A., Gray K., Krause K. First year students' experiences with technology: Are they really digital natives? *Australian Journal of Educational Technology*, 2008, vol. 24, no. 1. DOI: 10.14742/ajet.1233
18. Kukulska-Hulme A. How should the higher education workforce adapt to advancements in technology for teaching and learning? *The Internet and Higher Education*, 2012, vol. 12, is. 4, p. 247–254. DOI: 10.1016/j.iheduc.2011.12.002
19. Kaiser H. F. An index of factorial simplicity. *Psychometrika*, 1974, vol. 39, p. 31–36. DOI: 10.1007/BF02291575

Definition of Terms

Bartlett's Test of Sphericity: “compares an observed correlation matrix to the identity matrix. Essentially it checks to see if there is a certain redundancy between the variables that we can summarize with a few number of factors” (Statology.com, 2019, para 1). <https://www.statology.org/bartletts-test-of-sphericity/#:~:text=Bartlett's%20Test%20of%20Sphericity%20compares,are%20orthogonal%2C%20i.e.%20not%20correlated.>

Constructs: “Constructs are mental abstractions that we used to express the ideas, people, organisations, events and/or objects/things that we are interested in. Constructs are a way of bringing theory down to earth, helping to explain the different components of theories, as well as measure/observe their behaviour” (LaerdDisseration.com, 2012, para 2). <http://dissertation.laerd.com/constructs-in-quantitative-research.php>

Eigenvalues: “Eigenvalues are a special set of scalars associated with a linear system of equations (i.e., a matrix equation) that are sometimes also known as characteristic roots, characteristic values, proper values, or latent roots” (WolfmanMathWorld, 2020, para 1). <https://mathworld.wolfram.com/Eigenvalue.html>

Exploratory Factor Analysis: “is a statistical technique that is used to reduce data to a smaller set of summary variables and to explore the underlying theoretical structure of the phenomena. It is used to

identify the structure of the relationship between the variable and the respondent” (StatisticsSolutions, 2020, para 1). <https://www.statisticssolutions.com/factor-analysis-sem-exploratory-factor-analysis/>

Inservice training: Professional development provided to teachers who are currently teaching in educational institutions.

Internal consistency: “Internal consistency reflects the extent to which items within an instrument measure various aspects of the same characteristic or construct”. https://link.springer.com/referenceworkentry/10.1007%2F978-94-007-0753-5_1494

Kaiser—Meyer—Olkin (KMO) Measure of Sampling Adequacy (KMO) test: “is used in research to determine the sampling adequacy of data that are to be used for Factor Analysis. Social scientists often use Factor Analysis to ensure that the variables they have used to measure a particular concept are measuring the concept intended. The KMO test allows us to ensure that the data we have are suitable to run a Factor Analysis

and therefore determine whether or not we have set out what we intended to measure. The statistic that is computed is a measure of 0 to 1. Interpreting the statistic is relatively straightforward; the closer to 1, the better” (How-to Guide for IBM SPSS Statistics Software, 2009, para 3). <https://methods.sagepub.com/dataset/howtoguide/kmo-nilt-2012>

Perceptions: “the quality of being aware of things through the physical senses, especially sight” (dictionary.cambridge.org).

Pre-service training: professional development provided to college students who are enrolled in education major.

Qualtrics online survey software: “Qualtrics is a simple to use web-based survey tool to conduct survey research, evaluations and other data collection activities” (CaliforniaStateUniversity, 2020, para 1). <https://csulb.libguides.com/qualtrics>

Tech-Savvy: Someone who is digitally skillful and is able to navigate through digital platforms at ease.

ОПРЕДЕЛЕНИЕ НАДЕЖНОСТИ И ДЕЙСТВЕННОСТИ ИНСТРУМЕНТА ДЛЯ ИЗМЕРЕНИЯ ПРАКТИКИ ВОСПРИЯТИЯ И ПРИМЕНЕНИЯ ЦИФРОВОЙ ГРАМОТНОСТИ ПРЕПОДАВАТЕЛЕЙ ВУЗОВ

Б. Брактия¹, Л. Э. Хаас¹, А. М. Монтенегро Санчес², А. В. Коптелов¹

¹ Государственный университет Сэма Хьюстона
Huntsville, TX 77341, United States

² Университет Коста Рики
San Pedro Montes de Oca, San José, 11501, The Republic of Costa Rica

Аннотация

Целью данного исследования была разработка надежного и действенного инструмента для изучения восприятия и практики применения цифровой грамотности в области образования профессорско-преподавательским составом высших учебных заведений. Опрос проводился среди преподавателей педагогического колледжа университета на юго-востоке Техаса. Исследовательский факторный анализ (EFA — The Exploratory Factor Analysis) выявил четыре фактора с собственным значением больше единицы. Используемый инструмент из 20 пунктов объяснил 65,08 % дисперсии моделей взаимоотношений между заданиями: 36,49 % — F1: «Цифровая грамотность помогает мне учить», 11,02 % — F2: «У меня есть компетенция и ресурсы в области цифровой грамотности», 8,99 % — F3: «Цифровая грамотность поддерживает обучение студентов», 8,58 % — F4: «Студенты обладают цифровой грамотностью». Этот инструмент был признан надежным в определении представлений и практики работы преподавателей в плане восприятия и применения цифровой грамотности.

Ключевые слова: высшее образование, цифровая грамотность, восприятие, инструменты опроса, надежность, валидность, практика работы.

DOI: 10.32517/0234-0453-2021-36-1-33-37

Для цитирования:

Брактия Б., Хаас Л. Э., Монтенегро Санчес А. М., Коптелов А. В. Определение надежности и действенности инструмента для измерения практики восприятия и применения цифровой грамотности преподавателей вузов // Информатика и образование. 2021. № 1. С. 33–37. (На англ.)

Статья поступила в редакцию: 30 октября 2020 года.

Статья принята к печати: 24 ноября 2020 года.

Сведения об авторах

Брактия Бахия, доктор педагогики, научный сотрудник кафедры лидерства в образовании, Государственный университет Сэма Хьюстона, Техас, США; bxb039@shsu.edu; ORCID: 0000-0001-6498-6997

Хаас Лори Э., доктор педагогики, доцент, координатор программы Field II Experience & Undergraduate Reading, Школа преподавания и обучения, Педагогический колледж, Государственный университет Сэма Хьюстона, Техас, США; leh015@shsu.edu; ORCID: 0000-0001-6831-8451

Монтенегро Санчес Ана Марсела, доктор педагогики, профессор кафедры современных языков, Университет Коста-Рики, Сан-Хосе, Республика Коста-Рика; amm179@shsu.edu; ORCID: 0000-0001-9706-1157

Коптелов Андрей Витальевич, канд. пед. наук, доцент, директор центра международного обучения, Школа преподавания и обучения, Педагогический колледж, Государственный университет Сэма Хьюстона, Техас, США; axk022@shsu.edu; ORCID: 0000-0003-3590-8804