

Chapter # 8

LEARNING STYLE AND GENERATION Z IN HIGHER EDUCATION: A SCOPING REVIEW

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ABSTRACT

The aim of this study was to understand the characteristics of Generation Z's learning styles by mapping emerging empirical results through a scoping review applying the PRISMA framework. After retrieving 945 potential studies, we identified 21 empirical studies of Generation Z that used four scales related to learning style theories: the Gregorc Style Delineator; the Kolb Learning Style Inventory; the Felder-Silverman/Felder-Soloman Index of Learning Style; and the VAK/VARK Learning Model. A single dominant learning style of Generation Z students could not be specified because of the theories' different approaches. Studies showed a Concrete Sequential learning style from the Gregorc theory as a unimodal type; a Diverging learning style from the Kolb model; an Active, Sensing, Visual, and Sequential learning style from the Felder-Silverman/Felder-Soloman paradigm; and a Visual style of the VAK and a Kinesthetic style of the VARK. Based on the results, this study offers pedagogical and research implications.

Keywords: learning style, Generation Z, scoping review, higher education.

1. INTRODUCTION

Institutions of higher education now mostly enroll students of Generation Z, particularly in undergraduate programs, where they have substantially replaced Millennial students (Seemiller & Grace, 2016; Shatto & Erwin, 2016). This young generation represents individuals born between 1995-1997 and 2010-2012 (Dimock, 2019; Mohr & Mohr, 2017; Seemiller & Grace, 2017); scholars have proposed slightly different ranges of generational cut-off years (Dimock, 2019; Vojvodić, 2019). Like each predecessor generation—Silent, Baby Boomer, Generation X, and Millennials in order from old to new—Generation Z also has specific and unique characteristics (Shatto & Erwin, 2016; Shorey, Chan, Rajendran, & Ang, 2021), which have been strongly affected by information communication technology, social movements, and unsettled economic situations (Seemiller & Grace, 2017). Since higher education institutions must effectively engage with Generation Z (Seemiller & Grace, 2017), scholars and teachers need to understand this generation's characteristics.

Several recent studies on Generation Z illustrate its characteristics. For example, Seemiller and Grace (2017) described three distinct characteristics of Generation Z with regard to learning preferences, community engagement, and career aspirations based on their empirical findings. Isaacs, Scott, and Nisly (2020) discussed Generation Z's characteristics and integrated them into seven key themes—learning style, teaching preference, communication, feedback, technology, social media, and risk/financial views—which can differentiate between Generation Z and Millennials, even though both generations have

grown up in a similar era of advanced technology. To more profoundly understand unique learning aspects of Generation Z students, learning style has been specifically considered (Seemiller & Grace, 2016). Since learning style is an indicator of an individual's preferred way of learning in learning situations (Kolb & Kolb, 2017), it is critical to understand how Generation Z students typically learn in higher education institutions, which reflect today's technological and digitalized information environments. Yet, empirical research on the learning style of Generation Z only recently began in the context of higher education, and it remains uncertain to what extent recent work clarifies the learning style of Generation Z.

To the best of our knowledge, there is only one extensive review of research on Generation Z's learning style, which was conducted by Shorey et al. (2021). Their review applied a scoping review technique; however, coverage focused only on nursing or healthcare students. Additionally, their study was not limited to empirical research but encompassed various types of work, such as research reports, perspective papers, and commentary documents (Shorey et al., 2021). Accordingly, the aim of the current study was to understand the learning style of Generation Z as a whole, incorporating only empirical evidence-based research related to any educational program, major, or discipline. Consistent with our study aim, we had one research question: What are the learning styles of Generation Z?

2. LITERATURE REVIEW

2.1. Learning Style

For nearly half a century, the learning styles of individuals have been studied to seek answers to important issues relevant to learning and education in schools as well as organizations (Coffield, Moseley, Hall, & Ecclestone, 2004). Multiple definitions of learning style exist in the literature and may overwhelm educators and researchers (Desmedt & Valcke, 2004). In fact, the systematic and critical review study of Coffield et al. (2004) identified 71 learning style models and categorized five groups based on 13 significant models. According to their distinctive research purposes, several studies have used more than one learning style model to accompany their instruments (see Cassidy, 2004; Deng, Benkendoff, & Gao, 2022; Desmedt & Valcke, 2004; Hawk & Shah, 2007).

Coffield et al. (2004) classified learning style models. Using their classification, we excluded models belonging to the cognitive structure family, the stable personality type, and learning approaches or strategies based on the learning style. Instead, we focused on the descriptions of style models categorized into either the genetic component family, including human functioning modalities (i.e., visual, auditory, kinesthetic, etc.), or flexibility in stable learning preferences (see Coffield et al., 2004). Here, five learning style models are particularly relevant to those categories: Kolb's (1984) learning model (Kolb & Kolb, 2017), Gregorc's (1982) learning model (as cited in Cassidy, 2004), Fleming's (2019) VARK model (Fleming & Bonwell, 2019), Felder-Silverman's (Felder, & Silverman, 1988) learning model, and Dunn and Dunn's learning styles model (Honigsfeld & Dunn, 2003), all of which are well known and prominent, providing broadly available learning style measurements (Hawk & Shah, 2007). We believe that these learning models and their instruments are critical to providing useful information on how Generation Z students learn.

The first learning model is based on Kolb's (1984) experiential learning theory, which is characterized as playing an important role in individuals' experience (Kolb & Kolb, 2017). His model consists of two learning dimensions: grasping experience by the learning mode of concrete experience vs. abstract conceptualization; and transforming experience by the learning mode of reflective observation vs. active experimentation. Four learning modes become a foundation for four basic learning styles: Diverging, Converging, Assimilating, and

Accommodating. Kolb's Learning Style Inventory (Kolb, 1999) was developed to measure the extent to which people prefer to use each of the four learning modes in their learning situation. The latest Version 4 of Kolb's Learning Style Inventory was designed to identify nine typologies of learning styles (Kolb & Kolb, 2013).

The second learning model is Gregorc's (1982) Learning (Mind) Style Model (as cited in Cassidy, 2004). His learning model is composed of two dimensions: perceptual preference and ordering preference. The perceptual dimension involves how people receive information on one bipolar continuum between concrete ability and abstract ability, while the ordering dimension relates to how they deal with information on the other continuum between random ability and sequential ability (Harasym, Leong, Lucier, & Lorscheider, 1995). These preferences are combined to form four learning styles: Concrete-Sequential, Abstract-Sequential, Abstract-Random, and Concrete-Random. The Gregorc Style Delineator (Gregorc, 1982, as cited in Cassidy, 2004; Gregorc, 1985, as cited in Harasym et al., 1995) measures his proposed four types of learning styles.

The third learning model is Fleming's VARK learning style model (Fleming, 2019; Fleming & Bonwell, 2019). His model largely relates to a sensory paradigm developed from "the earlier neuro-linguistic model" (Hawk & Shah, 2007, p. 6). VARK is an acronym for Visual, Aural, Read/write, and Kinesthetic modalities. The VARK questionnaire was created to evaluate those four modalities (Fleming & Bonwell, 2019), while VAK inventories had existed for years (Fleming & Baume, 2006). Fleming added Read/write as a second visual modality, subdividing it from the Visual mode (Fleming & Baume, 2006; Fleming & Bonwell, 2019).

The fourth learning model is Felder-Silverman's learning model, which has five bipolar dimensions: Sensing vs. Intuitive, Visual vs. Auditory, Inductive vs. Deductive, Active vs. Reflective, and Sequential vs. Global (Felder & Silverman, 1988). Each dimension serves as a way of perceiving the world: receiving information, reasoning, processing perceived information, and understanding perceived information (Felder & Silverman, 1988). To assess learning preferences on the four dimensions without the dimension of inductive vs. deductive mode, the Index of Learning Style was initially developed by Felder and Soloman in 1991 and later provided as a revised version (Felder & Spurlin, 2005).

The fifth learning model is Dunn and Dunn's learning styles model (Dunn, Dunn, & Price, 1996, as cited in Honigsfeld & Dunn, 2003; Learning Abled Kids, 2023). Their learning model has five learning style stimuli: environmental (e.g., sound, light), emotional (e.g., motivation, persistence), sociological (e.g., learning alone, with peers), physiological (e.g., auditory, visual, kinesthetic), and psychological (e.g., analytic, global) (Dunn, 1984; Searson & Dunn, 2001). Each stimulus within the model includes several elements that people react to in new or difficult learning situations. To examine learning preferences with regard to the five stimuli, the Dunn and Dunn Learning Styles Inventory was developed as the newest version (Learning Abled Kids, 2023).

This description of the five learning style models reflects the classification based on Coffield et al. (2004). Several researchers have presented critical views about learning style assessments, commenting that they require more evidence for general educational application (Pashler, McDaniel, Rohrer, & Bjork, 2009).

2.2. Generation Z

Generation Z—also known as Gen Z, iGen, Net Generation, and Digital Natives (Albadi & Zollinger, 2021; Shorey et al., 2021)—is thought to always be connected with information communication devices and technology by using the Internet, cellular/mobile phones, tablets, instant messaging tools, video games, and digital music players (Prensky,

2001). This connection creates long-lasting interactions between Generation Z and digital environments, leading to unique learning characteristics that differ from those of previous generations (Prensky, 2001; Seemiller & Grace, 2017; Shatto & Erwin, 2016).

Several studies have highlighted certain learning characteristics of Generation Z (see Shorey et al., 2021). For example, Seemiller and Grace (2017) pointed out two aspects of Generation Z's learning characteristics: observation and intrapersonal learning. Regarding observation, Generation Z students prefer watching others do an assigned task before doing it themselves (Seemiller & Grace, 2017). For instance, Generation Z seeks information from videos or YouTube when encountering something difficult or hard to understand (Seemiller & Grace, 2017). The survey results of Mosca, Curtis, and Savoth (2019) supported this view, indicating that 98.5% of 133 university students favored the following statement: "Videos help to bring in real-world situations" (p. 72). Generation Z's preference to learn by watching may be captured and explained by another viewpoint. Prensky (2001) indicated that Digital Natives get accustomed to receiving information quickly by seeing graphics before reading texts. This notion suggests that they are more inclined to be observing learners (Shatto & Erwin, 2016), increasing visual learning ability (Cickovska, 2020).

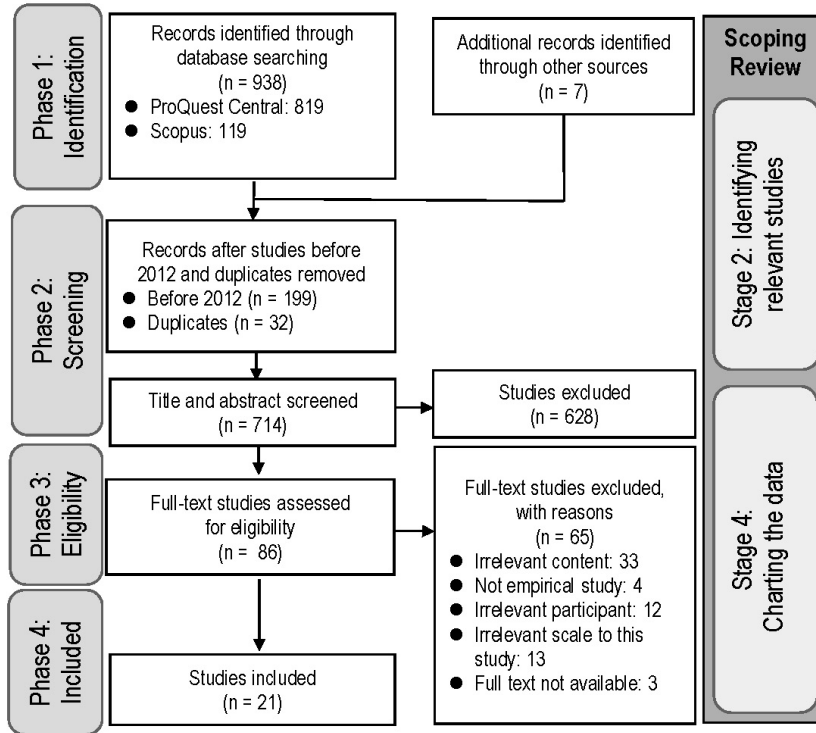
The other aspect is Generation Z's preference for intrapersonal learning (Seemiller & Grace, 2017). This learning characteristic is ascribed to "the individual nature of technology" that enables Generation Z to feel comfortable using it independently (Seemiller & Grace, 2017, p. 23). While Generation Z students communicate with others through mobile devices, they sometimes face challenges in face-to-face communication (Vojvodić, 2019). They prefer to learn in an individual learning setting where they can concentrate and maintain their personal pace (Seemiller & Grace, 2017). The tendency toward intrapersonal learning differs from the interpersonal approach of Millennials, who prefer collaboration or a teamwork orientation (Seemiller & Grace, 2017). This viewpoint is congruent with empirical results from Lai and Hong (2015), who found that the cohort of university students born after 1992 was statistically significantly different from the other two cohorts, born from 1982 to 1992 and born before 1982, with regard to preference for working in groups for schoolwork (Lai & Hong, 2015).

In addition to the above-mentioned learning characteristics, Generation Z students prefer to learn by doing and like to perform in "active learning environments" (Cickovska, 2020, p. 282), and they learn well by exploring and discovering (Oblinger & Oblinger, 2005). At a higher education institution, students exhibited their preference for engaging in hands-on opportunities for immediately applicable practices (Seemiller & Grace, 2017). This fact suggests that Generation Z students are pragmatic learners (Isaacs et al., 2020).

3. METHODS

This scoping review applied the guidance of Arksey and O'Malley (2005) and the PRISMA flowchart (Moher, Liberati, Tetzlaff, Altman, & The Prisma Group, 2009). Arksey and O'Malley (2005) outlined a five-stage approach, while the PRISMA flowchart has four phases (Moher et al., 2009; Peters et al., 2015); both groups of stages are depicted in Figure 1. The four phases within the PRISMA flowchart are (1) identification of studies, (2) screening of studies, (3) eligibility of studies, and (4) final inclusion of studies.

Figure 1.
PRISMA flowchart for a scoping review of Generation Z learning styles.



3.1. Stage 1: Identifying the Research Question

As presented in the research aims and questions, we had a research question: What are the learning styles of Generation Z? The research question was congruent with the aim of our study, which was to understand the learning style of Generation Z as a whole.

3.2. Stage 2: Identifying Relevant Studies

To find potential studies relevant to the learning styles of Generation Z, we utilized two databases: ProQuest Central and Scopus. ProQuest Central is the largest and most comprehensive multidisciplinary database of ProQuest. Scopus is also the largest and most reliable database that focuses on the studies addressing our topic.

Searches were carried out by applying the key terms with the search formula (“Generation Z” OR “Gen Z” OR “iGen” OR “Digital Natives” OR “Net Generation”) AND (“learning style” OR “preferred learning way”). The literature search was conducted on June 1, 2024. The search was limited to English-language sources in the publication categories of articles, conference papers, and book chapters, and it was conducted with no time boundary. The database search resulted in 938 potentially eligible studies: 819 from ProQuest Central and 119 from Scopus. To further find potentially eligible studies, we conducted an additional search using our research project of learning style and the reference sections of selected studies, as suggested by Siddaway, Wood, and Hedges (2019). With this effort, we added 5 articles and 2 conference papers, resulting in a total of 945 sources. To better manage the

studies, we eliminated 199 studies published in 2012 or earlier, since students born in 1995 typically enter higher education in 2013, resulting in a total of 746. Subsequently, we identified 32 duplicates to eliminate. Consequently, 714 studies remained for further investigation through title and abstract screening. Databases were independently reviewed and searched by the first and second authors, who confirmed that the number of publications targeted for the present research was consistent.

3.3. Stage 3: Study Selection

To be included, studies needed to be empirical studies that used a scale to measure the learning styles of the participants of Generation Z and showed quantitative results related to the participants' learning styles. To obtain potentially relevant studies on Generation Z's learning style in a broad manner, we not only focused on the participants explicitly described in publications as Generation Z, but also considered and investigated participants by academic year or age at higher education institutions. We selected studies using learning style scales relevant to the classifications discussed earlier: Kolb's Learning Style Inventory (Kolb, 1999), the Gregorc Style Delineator (Gregorc, 1982, as cited in Cassidy, 2004), the VARK Questionnaire (Fleming & Bonwell, 2019) including the VAK Inventories, the Index of Learning Style (Felder & Spurlin, 2005), and the Dunn and Dunn Learning Styles Inventory (Learning Abled Kids, 2023). Accordingly, to be included, the studies needed to apply those five learning style scales to measure students' learning style. Table 1 lists the criteria in detail.

Table 1.
Inclusion and Exclusion Criteria for the Scoping Review.

Category	Inclusion criteria	Exclusion criteria
1. Study type	Empirical study	Review, theoretical, or perspective study
2. Study sample	Participants in higher education belonging to Generation Z	Participants not belonging to Generation Z
3. Scale used	Kolb's Learning Style Inventory; Gregorc Style Delineator; the VARK Questionnaire including the VAK Inventories; Felder-Silverman's/Felder-Soloman's Index of Learning Style; Dunn and Dunn Learning Styles Inventory	Scale irrelevant to the five learning style models/scales
4. Language	English	Not English
5. Publication type	Article, book chapter, or conference proceedings	University-specific publication, working paper, dissertation, or thesis

3.4. Stage 4: Charting the Data

The fourth stage is similar to data extraction described in systematic reviews (Arksey & O'Malley, 2005). This stage is particularly associated with Phases 2, 3, and 4 of the PRISMA flowchart: Screening, which involves the analysis of titles and abstracts; Eligibility; and Inclusion. The first and second authors separately screened and analyzed the titles and abstracts of the 714 studies by applying the inclusion and exclusion criteria of Stage 3, followed by a discussion about the different studies selected. As a result, a total of 628 studies were removed, whereas 86 eligible studies remained for the eligibility process in Phase 3. Those studies were further analyzed independently by the same authors to determine which studies to include or exclude. Any discrepancies in decisions were discussed and consensus reached. Among the 86 studies, 65 were removed for reasons of having irrelevant content, not being empirical studies, having irrelevant participants, having irrelevant scales, and not

having full text available (Figure 1). Ultimately, 21 studies were included in the final study selection based on criteria.

The first author charted important information from the 21 studies for the extraction of data. Key characteristics and information in the included studies were listed in a summary, which the third author independently verified as aligning with the study aims and questions.

3.5. Stage 5: Summarizing and Reporting the Results

Although Stage 5 contains the term *collating* in the scoring review process of Arksey and O'Malley (2005), the present study removed the term because the primary activities in this stage were to summarize and report the results of the included studies. Table 2 lists the 21 included studies, noting publication information (author and year of publication); study design characteristics (sample, educational institution information, country, faculty/major/program, and scale/learning style model); and study results (major learning style of Generation Z). A separate table was created to present statistics based on learning style frequency for each learning style scale and model. To create this table, only data from participants in Generation Z from the 21 studies were used. We grouped the 21 studies into one of the five learning style models to examine students' learning styles and then investigated which learning style was the most dominant, as well as the second, third, and least dominant, based on that learning style model. The first author initially conducted these analyses, and the third author independently reviewed them to verify the percentages.

4. RESULTS

Table 2 highlights the context of each included study, the type of learning style models and scales applied, and the resulting preferred style of Generation Z, whereas Table 3 specifically addresses the research question: What is the learning style of Generation Z?

Table 3 is organized by the four classifications of learning style scales and models; it does not include the Dunn and Dunn learning styles model, since none of the 21 studies applied that model. Only one study used the Gregorc Style Delineator (Albadi & Zollinger, 2021). For that study, results showed that the dominant learning style of Generation Z is Concrete Sequential (43%) as a unimodal style as illustrated in Table 3.

Seven studies applied Kolb's Learning Style Inventory. For 32%, the most dominant learning style was the Diverging learning style, which consists of the two learning modes of concrete experience and reflective observation (Kolb, 1984; Kolb & Kolb, 2017). Although the Diverging learning style was most frequently the major learning style, a variety of learning styles with a range of percentages was observed in the entire group of Kolb's learning studies. This variation may result from several factors that include sample characteristics other than Generation Z, such as program type and country culture, as well as modifications of the learning style scale.

Table 2.
Characteristics and Results for Each of the 21 Studies Included in the Review.

Authors and year	Study characteristics				Results
	<i>N</i>	Educational institution	Faculty/major/program	Scale/learning style model	Major learning style of Generation Z
Albadi & Zollinger, 2021	466	University, USA	Interior design	Gregorc Style Delineator	Bimodal learning style; Concrete Sequential learning style as unimodal
Baherimoghadom et al., 2021	85 ^a	University, Iran	Dentistry	Felder-Soloman's Index of Learning Styles	Reflective, Sensing, Visual, & Sequential modes
Eid et al., 2021	113	University, Saudi Arabia	Medicine	VARC learning model	Multimodal learning style; additionally, Aural learning style as a unimodal style
Fahim et al., 2021	1473	University, Pakistan	Medicine and dentistry	VARC learning model	Multimodal learning style; additionally, Kinesthetic learning style as unimodal
Galingan, 2019	149 (360) ^b	University, Philippines	Engineering	Kolb's Learning Style Inventory and Felder-Silverman's Index of Learning Style	Reflector ^c (Diverging) learning style; Active, Sensing, Visual, and Sequential modes
Hanawi et al., 2022	84	University, Malaysia	Biomedical science	Learning Style Questionnaire (VAK learning model)	Visual learning style
Ishak et al., 2022	300	Undergraduate, Malaysia	Medicine, pharmacy, and allied health	VARC learning model	Multimodal learning style; additionally, Kinesthetic learning style as unimodal
Joonas et al., 2021	120 ^a	Undergraduate, Mexico	Not described	Kolb's Learning Style Inventory	Converging learning style
Manzoni et al., 2021	592 (870) ^b	University, Italy	MSc and executive education	Kolb's Learning Style Inventory	Assimilating learning style
Maulina et al., 2020	165	College, Indonesia	Physics teaching	VAK learning model	Visual learning style

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Authors and year	Study characteristics				Results
	<i>N</i>	Educational institution	Faculty/major/program	Scale/learning style model	Major learning style of Generation Z
Nossoni, 2021	33	University, USA	Engineering	Felder-Silverman's Index of Learning Style	Active, Sensing, Visual, and Sequential modes
Nwajiuba & Onyeneke, 2023	133	University, Nigeria	Science, social science, and humanities	VARK learning model ^d	Auditory learning style
Othman et al., 2019	305	University, Malaysia	Poly-tech	VAK learning model	Visual learning style
Payaprom & Payaprom, 2020	372	University, Thailand	Language	VARK learning model	Multimodal learning style; additionally, Kinesthetic learning style as unimodal
Reesman & Birdsong, 2023	112 (706) ^b	University, USA	Pilot flight	Felder-Soloman's Index of Learning Styles	Active, Sensing, Visual, and Sequential modes
Seemiller et al., 2019	701	College, USA	Not described	Kolb's Learning Style Inventory	Logic ^c (Assimilating) learning style
	1481	College, Brazil	Not described	Kolb's Learning Style Inventory	Logic (Assimilating) learning style
Silvestre et al., 2022	95	University, USA	Dentistry	VARK learning model	Visual learning style
Sousa, Mendonça, & Fontão, 2023	519	University, Portugal	Engineering	Kolb's Learning Style Inventory	Accommodating learning style
Toyama & Yamazaki, 2020	423	University, Japan	Business administration	Kolb's Learning Style Inventory	Diverging learning style
Turner & Gurenlian, 2023	89 (150) ^b	University, USA	Dental hygiene	Felder-Soloman's Index of Learning Styles	Active, Sensing, Visual, & Sequential modes
Yamazaki, Toyama, & Wijayanti, 2024	423	University, Indonesia	Elementary education	Kolb's Learning Style Inventory	Diverging learning style

Note. (a) Sample might include those born before 1995. (b) The number in parentheses indicates the total study sample, including those not in Generation Z. (c) This study used the original names for the learning styles based on Kolb's learning theory: the learning style of Theorist and Logic is the Assimilating learning style; that of Activist and Experience is the Accommodating learning style; that of Pragmatist and Practicality is the Converging learning style; and that of Reflector and Imagination is the Diverging learning style. (d) The VARK scale was slightly adjusted, measuring Visual, Auditorial, Tactile (Kinesthetic), and Social Interpersonal learning styles.

Table 3.
Learning Style Frequency Tendencies Shown in the 21 Studies Included in the Review^a

Learning style model or scale			Dominant learning style and mode							
Gregorc Style Delineator			Concrete Sequential		Concrete Random		Abstract Random		Abstract Sequential	
Albadi & Zollinger (2021) ^b			43%		26%		24%		6%	
Kolb's Learning Style Inventory ^c			Diverging		Assimilating		Converging		Accommodating	
Galingan (2019)			42%		7%		27%		23%	
Joonas et al. (2021)			15%		24%		37%		24%	
Manzoni et al. (2021)			25%		28%		22%		25%	
Seemiller et al. (2019): Brazil			19%		28%		25%		27%	
Seemiller et al. (2019): USA			23%		30%		24%		24%	
Sousa et al. (2023)			20%		22%		27%		30%	
Toyama & Yamazaki (2020)			46%		17%		4%		33%	
Yamazaki et al. (2024)			63%		28%		5%		4%	
Average % of each learning style			32%		23%		21%		24%	
Felder-Silverman's/ Felder-Soloman's Index of Learning Style			Active	Reflective	Sensing	Intuitive	Visual	Verbal	Sequential	Global
Baherimoghaddom et al. (2021) ^d			47%	53%	72%	28%	85%	15%	64%	36%
Galingan (2019)			56%	44%	70%	30%	79%	21%	73%	27%
Nossoni (2021)			64%	36%	67%	33%	82%	18%	67%	33%
Turner & Gurenlian (2022)			71%	29%	82%	18%	78%	22%	74%	26%
Average % of each learning style			59%	41%	73%	27%	81%	19%	69%	31%
VAK learning model			Visual		Auditory		Kinesthetic			
Hanawi et al. (2022): Analysis 1 ^e			62%		29%		10%			
Hanawi et al. (2022): Analysis 2			64%		1%		35%			
Maulina et al. (2020)			55%		27%		18%			
Othman et al. (2019) ^f			38%		31%		31%			
Average % of each learning style			55%		22%		23%			
VAKR learning model			Visual		Auditory		Kinesthetic		Read/write	
(1) Only unimodal			(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
(2) Unimodal & multimodal										
Eid et al. (2021)			24%	23%	41%	31%	26%	26%	9%	20%
Fahim et al. (2021)			31%	26%	23%	24%	34%	27%	13%	23%
Ishak et al. (2022)			14%	24%	15%	24%	42%	28%	29%	24%
Nwajiuba and Onyeneke (2023) ^g			25%		27%		25%		22%	
Payaprom and Payaprom (2020)			12%		25%		42%		22%	
Silvestre et al. (2022)			39%		19%		24%		18%	
Average % of each learning style			23%	25%	26%	25%	34%	28%	17%	22%

Note: (a) Among the 21 studies, the study of Reesman and Birdsong (2023) was excluded because it did not present learning style frequency for Generation Z. Several percentages of each learning style were calculated based on statistics reported in the studies. Also, the percentage of each study in this table represented a ratio of each learning style frequency divided by the total sample or total frequency in each study. (b) Albadi and Zollinger (2021) reported only unimodal styles. (c) This study used names of learning styles based on Kolb's learning theory, where the Theorist, Analyst, and Logic styles (see Galingan, 2019; Seemiller et al., 2019 in order) are Assimilating; Activist, Dynamic, and Experience are Accommodating; Pragmatist, Practice, and Practicality are Converging; and Reflector, Innovator, and Imagination are Diverging. (d) The results of Baherimoghaddom et al. (2021) were used based on students' frequency distribution of each learning mode in the four learning dimensions. (e) Hanawi et al. (2022) conducted two analyses of learning style examination. (f) Othman et al. (2019) showed combined unimodal and multimodal results for the three learning styles. (g) The name of the learning style used in their study was changed to Tactile from Kinesthetic, and to Social Interpersonal from Read/write (Nwajiuba & Onyeneke, 2023).

Five studies employed the Felder-Silverman or Felder-Soloman Index of Learning Style. Among them, the study of Reesman and Birdsong (2023) was excluded because it did not present the learning style frequency of Generation Z. As illustrated in Table 3, except for a Reflective learning style in the study of Baherimoghadom, Hamedani, Mehrabi, Naseri, and Marzban (2021), all study results were consistent: the dominant learning style for Generation Z was Active, Sensing, Visual, and Sequential.

Among the final nine studies, three used the VAK model and six used the VARK model. The Visual learning style was the single dominant learning style modality in 55% of participants for the VAK learning model. The analysis for the six VARK model studies considered both unimodal and multimodal learning styles. For both, the dominant learning style was Kinesthetic, with 34% of a unimodal type and 28% of the multimodal type. In contrast, the study of Eid et al. (2021) revealed an Auditory learning style as dominant. This difference in unimodal learning styles might be attributed to cultural differences between Saudi Arabian students (i.e., Eid et al., 2021) and other students (Pakistani: Fahim et al., 2021; Malaysian: Ishak, Ranganathan, & Harikrishnan, 2022; Thai: Payaprom & Payaprom, 2020). Eid et al. (2021) discussed the effect of culture and student background on learning style preferences when comparing the learning styles of medical students between two countries. Hofstede (1997) demonstrated that a country's culture forms and develops people's ways of learning through their socialization process, suggesting that students from one cultural background may differ from those of another. As culture, a macro-level context, shapes students' learning styles, other contexts such as regions, societies, educational institutions, and department majors may affect students' preferred learning. Accordingly, the discussion of Eid et al. (2021) suggests that other determinants can influence learning style formation and development.

5. DISCUSSION

5.1. Implications

Our research offers two implications. The first relates to pedagogical approaches for effective Generation Z learning, and the second relates to future prospects for a scoping/systematic review on Generation Z in higher education and the workforce.

First, it is critical to consider how teachers or instructors determine course design in and out of class based on the learning styles of Generation Z students. Generally speaking, even though most Generation Z students may have a visual learning style, which makes them feel comfortable with social media pictures, videos, and YouTube as learning tools, a minority of students might prefer to learn through hands-on experiences that require face-to-face discussions with immediate feedback, actual experimentation in class, trial-and-error approaches, and role-play with classmates in an educational program. Thus, to promote effective learning among diverse Generation Z students, a one-size-fits-all approach may not work. Future studies may want to address how instructors should structure instructional methods to educate students with diverging learning styles in action learning contexts, to accommodate kinesthetic learners in flipped classrooms, or to motivate sequential learners in hybrid learning classes. Also, future studies should consider digital instructional approaches, which are highly relevant to Generation Z, including blended learning, gamification, and microlearning. It will be important to examine Generation Z students' learning styles in higher education, investigating how a variety of instructional approaches facilitate their learning, motivation, and performance.

The second implication concerns an opportunity for review studies on Generation Z. A limitation of our review was the relatively small number of 21 empirical studies, which were then subdivided into much smaller numbers based on the specific learning style models and scales they applied. The paucity of empirical studies may be due to the timing of the current study. Considering that Generation Z refers to individuals born between 1995–1997 and 2010–2012, it has been approximately 10 years since they showed up in higher education institutions or the workforce. As more Generation Z individuals enter targeted research sites, studies will be able to obtain more data. Accordingly, there may be opportunities for additional scoping/systematic reviews that provide further integrative insight into Generation Z's learning style.

5.2. Limitations

This study has several limitations. First, our review was limited to five learning style models to analyze the learning style of Generation Z. Although these models were valid and based on the classification of learning style models by Coffield et al. (2004), other learning style models that may support empirical results were excluded. We believed that those five learning style models and their instruments would be more accessible to learning style researchers interested in the students of Generation Z. The second limitation was the limited number of 21 included studies, as discussed earlier. This may lead to potential biases based on those studies' cross-sectional designs, reliance on self-report tools, and various countries and background experiences. Third, this study viewed Generation Z as a monolithic group without considering its diversities. Learning styles may be shaped by individual differences, such as gender, ethnic background, socioeconomic status, and personality. It is important to consider the heterogeneity in Generation Z in relation to learning style in future studies. Fourth, this study focused only on Generation Z. Comparison with learning styles of other generations would provide richer information on the characteristics of Generation Z learning styles.

6. CONCLUSION

The aim of this study was to understand the characteristics of Generation Z's learning styles in various academic disciplines of educational institutions. Our scoping review had three conclusions. First, the learning style of Generation Z varied based on the learning style model and scale applied; thus, a single dominant learning style of Generation Z could not be identified as a whole. Second, a predominant learning style could be specified for the varying learning style models and scales employed in this study. Third, nevertheless, it is important to examine whether the dominant learning style of Generation Z is unique as a generational characteristic compared with that of other generations such as Generations X and Y.

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*Literature used in systematic review