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FACTORS AFFECTING GPA IN HIGHER EDUCATION IN ASIA: A SYSTEMATIC REVIEW

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ABSTRACT: Academic achievement refers to the capacity of students in studying and is an important index that can be used to predict the beginning salary and salary growth rate. Although there are multiple studies investigating factors that affect academic achievement, the review that summarized the factors is scarce. This review summarized the literature describing academic achievement and investigated the importance of the factors that affected academic achievement described as grade point average (GPA). ScienceDirect, PubMed, Scopus, and CINAHL databases were systematically searched for the literature that investigated the impact of covariates on GPA; was conducted in higher education in Asia; and was published from January 2001 to June 2021. We found 65 studies that met the inclusion criteria. 67.69% of the studies were conducted in Southwest Asia. Factors concerning the academic performances of students could be classified as demographic factors, psychological factors, admission criteria, learning-related daily habits, and learning environment. This review showed that academic achievement was most likely affected by psychological factors. Negative psychological factors impeded academic achievement while positive psychological factors improved academic achievement. Such factors can be incorporated into learning and classroom management to improve the academic achievement of students. Negative factors, when are known, can be avoided or even negated.

INDEX TERMS: academic achievement, demographic, psychology, learning-related daily habits, admission criteria, learning environment

1. INTRODUCTION

The success of students in an academic setting is a result of multiple factors including academic achievement [1]. Students' academic achievement represents performance results that show the level or degree to which a person has attained specific aims that were the goals of schools, colleges, universities, and other instructional places. In other words, academic achievement demonstrates the ability of students in performing studying-related tasks e.g., communicating the correct information, and obtaining knowledge, [2]. Academic achievement is the most commonly used indicator [3] for the knowledge and skills that students possess [4] and is one of the most important indicators for employment and career advancement [5]. Achievement for studying is assessed by the GPA (grade point average) or by standardized measurement [6]. University students' performances are usually shown by using grade point average (GPA), which indicates, the average of scores from weighted subjects needed for the assessment of the degree aimed at. For students to qualify for postgraduate study and work after graduation, grade point average is the key criterion of occupational status [7]. There are multiple studies investigating factors that affect academic achievement. However, the review that summarized such factors is scarce. Those factors can be incorporated into learning and classroom management to improve the academic achievement of students. Negative factors, when are known, can be avoided or even negated.

2. RESEARCH OBJECTIVES

This review aimed to summarize the literature describing the GPA of students in education higher than high school level in Asia and to investigate the importance of the related factors on GPA.

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3. LITERATURE REVIEW

Grade point average (GPA), the weighted average of the total course grades, is the most commonly used surrogate for academic achievement [1, 8-11]. In addition, overall GPA is an important variable used in educational research to explain academic achievement because of its high reliability and strong predictive validity of academic performance [12]. The predictors of students' GPA have included gender, pre-transfer GPA, post-transfer GPA difference, and the number of courses per summer semester [13]. The importance of the GPA extends well beyond the academic realm. GPA has relationships with multiple important job-related outcomes e.g. future work readiness [14], job engagement [15], job performance [16], job satisfaction, and salary level and growth [17]; therefore GPA has been being used as a selection tool in employment [18].

GPA is undeniable and there are numerous studies on factors that affect GPA and academic achievement. For example, neighborhood context [19], parenting styles [20], and students' motivation [21, 22] positively affect academic achievement while alcohol and marijuana use [23], depression [24], game addict [25], mobile usage [26], and smoking [27] are negatively associated with academic achievement. Some factors including the lifestyle learning of students [28-30], and social networks [31, 32] have inconclusive relationships with GPA. Moreover, GPA is diverse in different cultures and levels of education so how each factor affects GPA in general highly depends on the settings. Differences in GPA among ethnicities exist and may involve several explanatory factors including academic effort [33], educational activities [34], interactions with home and school [35], learning experiences and expectations [36], and parenting styles [35]. The effect of culture is profound, especially in international students [37] and students with immigration status [33]. In terms of educational level, a few studies found that undergraduate GPA is not a good predictor for graduate students' academic achievement [12, 38], meaning that one variable that is a good predictor in one educational level might not be a good predictor in another level.

4. RESEARCH METHODS

A. Literature search

Computerized literature searches to identify studies investigating factors affecting academic achievement from January 2001 to June 2021 were performed using ScienceDirect, PubMed, Scopus, and CINAHL databases. ScienceDirect search resulted in 1,917 hits. The searches in Scopus, PubMed, and CINAHOL retrieved 1,726; 1,084; and 50 hits, respectively. Terms related to academic achievement (e.g., academic achievement, academic performance, GPA) were searched.

B. Inclusion of studies

After the removal of duplicate entries from all databases, studies were excluded if they were 1) the study that academic achievement was not measured as GPA, 2) not conducted in Asia, 3) not conducted in the school or the university, 4) not in higher education, 5) not observational e.g. experimental studies, 6) qualitative research, and 7) reviews. After careful consideration of the studies, the final number of studies included in this review is 65. The Reporting Items for Systematic Reviews (PRISMA) diagram of the systematic literature search and review process is shown in Fig 1.

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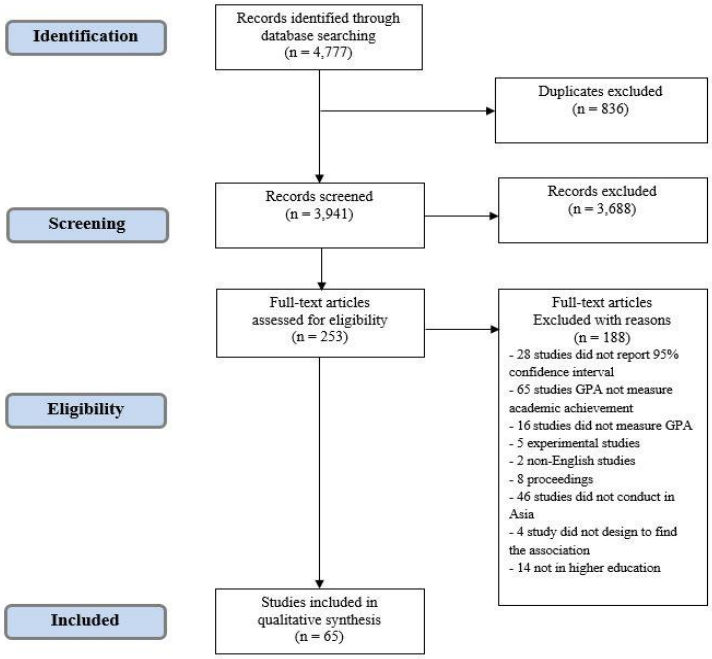

Fig 1. PRISMA diagram for systemic review of the factors having effects on academic achievement.

The results were classified as positive, negative, and no association when the results of every included article demonstrated positive, negative, and no association between the considered factors and GPA, respectively. The inconclusive association was reported when the included articles showed a mixed association between the factors and GPA. All factors that were retrieved in this review are presented in Table I-VI.

5. RESEARCH RESULTS

The review retrieved 4,777 nonredundant articles. Sixty-five articles conducted in universities with 53,897 participants were included for the systematic review. 67.69% of the studies were conducted in Southwest Asia (Iran, Jordan, Kuwait, Lebanon, Saudi Arabia, Turkey, and United Arab Emirates). 32.31% of the studies were conducted in Southeast Asia (Malaysia, Indonesia, and Thailand), East Asia (China, Japan, Hong Kong, and Korea), West Asia (Palestine), and South Asia (Pakistan) (Table I). The included studies reported sex for 43.99% of the participants of which 59.87% were female. In other words, 56.01% of the participants did not have information on sex. The Grade Point Average (GPA) was defined by various definitions e.g. the grade average at the end of the first year [39], the grade average at the end of the second year [40], the grade average at the end of the third year [41], the highest academic grades [42], the final GPA before graduation [30], and the religion course grades [43]. Factors concerning the academic performances of students were classified into internal (demographic factors and psychological factors) and external factors (learning-related daily habits, admission criteria, and learning environment).

A. Demographic factors

From the systematic search, ten studies investigating the effect of demographic factors on GPA were found. Being female [44, 45] was positively associated with GPA. Smoking negatively affected GPA [46]. However, sleeping hours [47, 48], BMI [42], and physical activity [49-52], the association with GPA is inconclusive. However, it could explain 84% of the variance in GPAs [51]. The demographic of the studies and summary statistics are shown in Table II.

B. Psychological factors

Twenty-one studies that investigated the effect of psychological factors on GPA were identified (Table III). We found that emotional intelligence (EQ) [53-55], mental health [56], grit [57], motivation [58], motive [59],

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orderness [60], positive affect [61], reflective thinking [62], satisfaction of faculty [63], self-efficacy [64, 65] , self-perception [66], and study skills [67] were positively associated with a higher GPA. EQ [54, 55], orderness [60], and self-efficacy [64, 66] explained 1.9%-22.6%, 3.1%, and 1.9%-15.4% of

Table I Location and demographics of studies

No	Authors	Location (year of study)	N	Sex (male:female:unknown)	Age min-max (mean ± SD; years)
1	Vitasari et al. (2010)	University Malaysia Pahang, Malaysia (ND)	205	96:109:0	18-26 (ND)
2	Beşoluk et al. (2011)	Sakarya University Faculty of Education, Turkey (ND)	1,471	577:894:0	18-25 (20.59 + 1.55)
3	DordiNejad et al. (2011)	Medical university, Iran (ND)	150	70:80:0	18-39 (22 + 2.96)
4	Hassanbeigi et al. (2011)	Sahid Sadoughi University, Iran (ND)	223	70:153:0	Male 19-37 (22.73 ± 3.08), female 19-37 (23.01 + 2.73)
5	Nihayah et al. (2011)	University Kebangsaan Malaysia, Malaysia (2009-2010)	104	23:81:0	19-24 (ND)
6	Albishri et al. (2012)	Saudi Arabia (January 2011 and February 2012)	727	ND:ND:727	ND
7	Ayyash-Abdo and Sanchez-Ruiz (2012)	Lebanese university, Lebanon (ND)	1,401	682:719:0	ND (20.07 + 3.10)
8	Din et al. (2012)	University Technology MARA, Selangor, Malaysia (2012)	30	ND:ND:30	ND
9	Guraya and Zolaly (2012)	The College of Medicine Taibah University, Saudi Arabia (2010-2011 and 2011-2012)	240	122:118:0	ND
10	Odeh (2012)	Zarqa Private University, Jordan (2008-2009)	304	29:275:0	ND
11	Pepe (2012)	Mehmet Akif Ersoy University, Turkey (ND)	51	ND:ND:51	ND
12	Wan Chik et al. (2012)	Malaysian university, Malaysia (January 2011)	147	ND:ND:147	ND (20.0 ± 1.5)
13	Al Alwan et al. (2013)	Health Sciences Colleges and College of Medicine at King Saud Bin Abdul Aziz University, Saudi Arabia (2000-2010)	1,905	91:1,814:0	ND
14	Nuzhat et al. (2013)	King Saud Bin Abdul Aziz University for Health Sciences, Faculty of Medicine, Saudi Arabia (2011-2012)	146	74:72:0	ND
15	Saad Al-Saud (2013)	The College of Dentistry, King Saudi University, Saudi Arabia (ND)	124	72:52:0	ND
16	Bostani et al. (2014)	Islamic Azad University Ahvaz branch, Iran (ND)	200	ND:ND:200	ND
17	Chotitham et al. (2014)	Chulalongkorn University, Thailand (ND)	101	38:63:0	18 (ND)
18	Erten (2014)	University in Ankara,Turkey (ND)	188	57:131:0	ND
19	Hamaideh and Hamdan-Mansour (2014)	Al-Maarefa College, Saudi Arabia (2012–2013)	510	245:265:0	ND
20	Usman et al. (2014)	Malaysia (ND)	120	ND:ND:120	ND
21	Zhou et al. (2014)	Southern Medical University, China (2011)	1,285	512:773:0	ND
22	Al-Ansari and El Tantawi (2015)	University of Dammam, Saudi Arabia (2012-2013)	186	ND:ND:186	19-24 (ND)
23	Alhadlaq et al. (2015)	King Saud University, Saudi Arabia (2008-09 to 2010-11)	955	538:417:0	ND
24	Almigbal (2015)	King Saud University in Riyadh, Saudi Arabia (2012-2013)	600	283:317:0	ND
25	Al Shawwa et al. (2015)	King Abdulaziz University, Faculty of Medicine, Jeddah, Saudi Arabia (2012)	359	175:184:0	ND
26	Chen (2015)	Hong Kong (ND)	339	124:215:0	ND (20.50 ± 1.13)
27	Liu et al. (2015)	Hong Kong (ND)	462	152:310:0	18-29 (20.75 ± 1.74)
28	Shareef et al. (2015)	Alfaisal University, Saudi Arabia (ND)	335	154:181:0	ND
29	Alaki et al. (2016)	King Abdulaziz University Faculty of Dentistry, Saudi Arabia (2013-2014)	146	71:75:0	ND
30	Al-Drees et al. (2016)	King Saud University, Saudi Arabia (2012–2013)	409	205:204:0	ND
31	Arbabisarjou et al. (2016)	Zahedan University of Medical Sciences, Iran (2015)	200	51:149:0	ND (22.74 + 2.22)
32	Kabrita and Hajjar-Muça (2016)	Six private and public universities, Lebanon (2010-2011)	540	267:273:0	17-25 (ND)
33	Lee et al. (2016)	Kangwon National University Medical School Korea, Korea (2011-2013)	92	49:43:0	ND (26.0 ± 3.44)

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34	Nouh et al. (2016)	Medical colleges in Riyadh, Saudi Arabia (2014)	193	130:63:0	ND (23.7 ± 1.4)
35	Paiboonsithiwong et al. (2016)	Chiang Mai University, Thailand (2014)	140	56:84:0	ND (18.86 ± 0.74)
36	Rashid and Asghar (2016)	Saudi Arabia (ND)	761	ND:ND:761	ND (20.79 + 1.97)
37	Almoajel et al. (2017)	Humanist and Sciences Colleges, King Saud University, Saudi Arabia (ND)	310	0:310:0	18-25 (ND)
38	Ghanizadeh and Jahedizadeh (2017)	Universities, Mashhad, Iran (October and December 2014)	187	75:112:0	20-32 (22.5 ± 3.06)
39	Halboub et al. (2017)	Jazan University, Saudi Arabia (2015-2016)	348	186:162:0	20-25 (ND)
40	Suraya et al. (2017)	College of Medicine, King Saud University, Saudi Arabia (November 2014 to June 2015)	91	ND:ND:91	ND (21.31 + ND)
41	Akbarilakeh (2018)	Zahedan University of Medical Sciences, Iran (2016-2017)	50	34:16:0	ND
42	Cao et al. (2018)	The University of Electronic Science and Technology of China, China (September 2009-March 2015)	18,960	ND:ND:18,960	ND
42	Ibrahim et al. (2018)	King Abdulaziz University, Jeddah, Saudi Arabia (2016-2017)	160	83:77:0	ND (21.60 ± 2)
44	Onchang and Hawker (2018)	Silpakorn University (Sanamchantra Palace Campus), Thailand (2016)	786	212:574:0	ND
45	Sahin et al. (2018)	The physical education and sports teaching department of a university in the Central Black Sea region of Turkey, Turkey (ND)	127	85:42:0	16-30 (19.22 ± 1.80)
46	Tiyuri et al. (2018)	Tehran University of Medical Sciences, Iran (2016)	320	152:168:0	ND (27.83 + 4.3)
47	Yunita et al. (2018)	Universitas Pertamina in Jakarta, Indonesia (2017/2018)	513	262:251:0	ND
48	Alamri (2019)	Saudi Arabia (2016-2017)	132	56:76:0	ND
49	Li et al. (2019)	Chinese university, China (1 September 2013 to 31 August 2014)	8,917	ND:ND:8,917	ND
50	Aleidi et al. (2020)	Two public Universities, Jordan (March to June 2018)	628	134:494:0	ND
51	Alkhateeb (2020)	The University of Jordan, Jordan (2014-2015)	235	147:88:0	ND (22 ± ND)
52	Awadalla et al. (2020)	University in United Arab Emirates, United Arab Emirates (2018-2019)	404	114:290:0	ND (19.6 ± 2.76)
53	Bou-Hamad (2020)	University in Lebanon, Lebanon (2018)	112	51:61:0	ND
54	Gemnani et al. (2020)	SMBB Medical University, Pakistan (January-February 2020)	255	119:136:0	ND (20.92 ± 1.62)
55	Halimi et al. (2020)	Private University, Kuwait (2018)	480	166:314:0	ND (20.6 ± 3.13)
56	Jawad & Shalash (2020)	Al- Quds Open University, Palestine (2010 – 2013)	382	115:267:0	ND
57	Lin et al. (2020)	Fujian Medical University, China (November 2018 to February 2019)	347	132:215:0	ND (20.43 + ND)
58	Mei et al. (2020)	Chinese university, China (February 27th, 2017 to June 25th, 2017)	372	296:76:0	ND
59	Nawa et al. (2020)	Tokyo medical and Dental University, Japan (2013 and 2014)	103	57:46:0	ND
60	Samaha & Hawi (2020)	Notre Dame University, Lebanon (ND)	345	255:90:0	ND (19.93 ± 2.08)
61	Toraman et al. (2020)	Ankara University, Turkey (2017)	1,573	552:1,021:0	ND
62	Aljadani et al. (2021)	Hail University, Saudi Arabia (May to June 2019)	218	97:121:0	ND
63	Abubakar et al. (2021)	A public university, Malaysia (December 2019 and January 2020)	247	73:174:0	ND (21.4 + 1.5)
64	Alhurishi et al. (2021)	Three College, Saudi Arabia (2016–2017 and 2018–2019)	1,634	799:835:0	ND
65	Al-Momani (2021)	Medical college students of King Saud University, Saudi Arabia (March 2019)	312	248:64:0	ND (21.9 ± 1.0)

ND: no data

the variance in GPAs, respectively. On the other hand, amotivation [68], anxiety [69, 70], depression [71, 72]), and stress [73] were negatively associated with GPA. The aforementioned studies reported that amotivation [68], anxiety [70], depression [71, 72], satisfaction from faculty [63], and stress explained 3.4%, 7%, 30.9-1.8%, 49.7%, and 13.4% of the variance in GPAs, respectively.

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Table II Studies demonstrating the relationship between demographic and academic achievement

No.	Authors	Study design	Research instrument	Indicator	Statistic	Interaction with sex	Academic performance
1	Nihayah et al. (2011)	Survey	Questionnaire	Sleeping hours	χ^2-test, $P > 0.05$	ND	CGPA
2	Wan Chik et al. (2012)	Survey	Maelcod clark professional identities (MCPIS-9)	Sex	t-test, $B = -0.44$, $P < 0.001$, $R^2 = 0.211$, effect size = 0.8	Males had lower academic performance than female	GPA at the end of the study blocks
3	Shareef et al. (2015)	Survey	Self-administered questionnaire (WHOQOL-BREF)	Physical health	$r = 0.29$, $P < 0.001$	Male and female students had similar academic performance	GPA
4	Al-Drees et al. (2016)	Cross-sectional	Self-administrated questionnaire	Physical activity habits	χ^2-test, $P = 0.001$	ND	GPA
5	Arbabisarjou et al. (2016)	Cross-sectional	Demographic questionnaire	Sex	t-test, $P = 0.002$	Correlation between gender and academic achievement was significant	GPA
6	Almoajel et al. (2017)	Survey	Self-administered questionnaire	Physical activity	χ^2-test, $P < 0.001$	ND	GPA
7	Suraya et al. (2017)	Cross-sectional	The obesity index	Body mass index	t-test, $P = 0.022$	ND	Highest academic grades
8	Aleidi et al. (2020)	Cross-sectional	Questionnaire	Smoking	OR = 2.752, $P < 0.001$	ND	GPA
9	Gemnani et al. (2020)	Cross-sectional	Questionnaire	Excessive daytime sleepiness	χ^2-test, $P = 0.006$	ND	GPA
10	Al-Momani (2021)	Cross-sectional	Questionnaire	Physical activity score	F test, $P = 0.647$	ND	GPA

GPA: Grade Point Average; CGPA: Cumulative Grade Point Average; ND: no data

Table III Studies demonstrating the relationship between psychological and academic achievement

No.	Authors	Study design	Research instrument	Indicator	Statistic	Interaction with sex	Academic performance
1	Vitasari et al. (2010)	ND	Questionnaire: State trait anxiety inventory	STAI scores	$r = -0.264$, $P = 0.000$	ND	GPA
2	DordiNejad et al. (2011)	Cross-sectional	Sarason test anxiety questionnaire	Level of test anxiety	χ^2-test, $P < 0.05$	ND	GPA of the last semester at the time of research
3	Hassanbeigi et al. (2011)	Cross-sectional	EQ-i-questionnaire	EQ-i-scores	$r = 0.14$, $P = 0.039$	EQ-i-scores between male and female students were not significantly different	GPA
4	Ayyash-Abdo and Sanchez-Ruiz (2012)	Survey	Questionnaires	Positive affect	$\beta = 0.13$, $P < 0.001$	ND	GPA
5	Pepe (2012)	Survey	ND	Study skills	χ^2-test, $P < 0.05$	ND	GPA
6	Bostani et al. (2014)	ND	General health questionnaire	Student's mental health total score	t-test, $P < 0.05$	ND	GPA
7	Chotitham et al. (2014)	ND	Questionnaire	Deep motive scores	χ^2-test, $P < 0.001$	ND	GPA
8	Erten (2014)	ND	Questionnaires	Amotivation scale	$r = -0.184$, $P < 0.05$	ND	GPA
9	Hamideh and Hamdan-Mansour (2014)	Cross-sectional	Self-administered questionnaire	Achievement motivation	$\beta = 0.222$, $P < 0.05$	ND	GPA
10	Liu et al. (2015)	ND	Questionnaires	Self-perceived overall competence scores	$r = 0.14$, $P < 0.01$	ND	GPA
11	Kabrita and Hajjar-Muça (2016)	Cross-sectional	ND	Depression scale	$r = -0.135$, $P < 0.05$	No significant difference between men and women in sleep quality	GPA
12	Ghanizadeh and Jahedizadeh (2017)	ND	Reflective thinking questionnaire	RTQ scores	T-test, $P < 0.05$	ND	GPA
13	Cao et al. (2018)	ND	Questionnaires	Orderness	$r = 0.178$, $P < 0.0001$	ND	GPA
14	Akbarilakeh (2018)	Cross-sectional	Questionnaires	EQ	$r = 0.472$, $P < 0.05$	ND	GPA at the 4th year
15	Tiyuri et al. (2018)	Cross-sectional	Self-efficacy scale	Self-efficacy score	$r = 0.393$, $P = 0.0001$	ND	GPA
16	Awadalla et al. (2020)	Cohort study	Questionnaire	Score symptoms of depression	$r = -0.176$, $P > 0.001$	ND	GPA
17	Halimi et al. (2020)	ND	Wong and Law Emotional Intelligence Scale	Emotional Intelligence Scale	F-test, $P = 0.05$	No significant between male and female on the use of emotion' scores ($P < 0.05$).	GPA
18	Lin et al. (2020)	Cross-sectional	Questionnaire	The perceived stress scale	$r = -0.116$, $P = 0.037$	ND	GPA
19	Toraman et al. (2020)	Survey	Questionnaire	Satisfaction from faculty Scale	$r = 0.705$, $P < 0.01$	ND	GPA
20	Abubakar et al. (2021)	Cross-sectional	Questionnaire	Grit-S scale	$r = 0.153$, $P = 0.02$	ND	GPA
21	Aljadani et al. (2021)	Cross-sectional	Questionnaire	Exhaustion, cynicism and professional efficacy scale	AOR = 0.17, $P = 0.039$	ND	GPA

GPA: Grade Point Average; ND: no data

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C. Admission criteria factors

Ten studies that investigated the effect of admission criteria factors on GPA were identified (Table IV). Multiple mini-interviews (MMIs) [74, 75], and the National College Entrance Examination (NCEE) [76] were positively associated with a higher GPA. MMIs explained approximately 18 % of the variance in GPAs. Although the high school grade average [41, 77-82] was inconclusively associated with GPA, it could explain 12.3%-42.2% [41, 78, 79] of the variance in GPAs.

Table IV Studies demonstrating the relationship between admission criteria and academic achievement

No.	Authors	Study design	Research instrument	Indicator	Statistic	Interaction with sex	Academic performance
1	Albishri et al. (2012)	ND	ND	High school grade	r = 0.22, P = 0.0000	ND	GPA at the 6th year
2	Guraya and Zohly (2012)	Cohort study	ND	High school GPA	χ^2-test, P > 0.05	ND	GPA of pre-clinical and clinical years
3	Al Alwan et al. (2013)	Cohort study	ND	Final high school grade	r = 0.65, P < 0.05	ND	GPA for three years
4	Zhou et al. (2014)	Survey	Questionnaires	The National College Entrance Examination (NCEE)	β = 3.04, P = 0.022	GPA of female was higher than male	First-year GPA
5	Alhadlaq et al. (2015)	Cohort study	ND	High school grade	r = 0.349, P < 0.01	ND	GPA at the 2nd year
6	Alaki et al. (2016)	ND	ND	Multiple mini-interviews	β = 0.146, P < 0.05	ND	GPA during the two years
7	Lee et al. (2016)	Cohort study	ND	Multiple mini-interviews	β = 0.427, P < 0.001	ND	GPA in medical courses for two years among
8	Sahin et al. (2018)	ND	ND	High school grade	β = 0.19, P < 0.05	ND	GPA at the 1st year
9	Nawa et al. (2020)	ND	ND	High school GPA	P > 0.05	ND	GPA
10	Alhurishi et al. (2021)	Retrospective cohort	High school grade	High school grade	β = 0.347, P = 0.000	ND	GPA

GPA: Grade Point Average; ND: no data

D. Learning-related daily habits factors

Nineteen studies that investigated the effect of learning-related daily habits factors on GPA were identified (Table V). Class time [83], frequency of library visits [84], information retrieval on Facebook [85], and student friendship network [86] were positively associated with a higher GPA. Internet gaming disorders were negatively associated with a GPA [87]. Frequency usage of electronic resources [88], internet addiction [89], and time spent with friends (every day) [90] had no association with GPA. Inconclusive relationships between GPA and frequency of mobile usage [26, 91], learning styles [30, 92-94], and social networking usage [31, 32, 95-97] were found. The frequent use of electronic devices [88], frequency of library visits [84], frequency of mobile usage [26], internet addiction [89], Internet gaming disorder [87], and social networking usage [95] explained 0.1%, 14.8%, 0.04%, 0.01%, 3.2%, and 6.1% of the variance in GPAs, respectively.

E. Learning environment factors

Five studies that investigated the effect of learning environment factors on GPA were identified from the systematic search (Table VI). Authoritative parenting style [98], E-learning strategy [99], and student perception of the learning environment [100, 101] were positively associated with a higher GPA while the association between GPA and community noise (traffic) [102] was negative.

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Table V Studies demonstrating the relationship between learning-related daily habits and academic achievement

No.	Authors	Study design	Research instrument	Indicator	Statistic	Interaction with sex	Academic performance
1	Beşoluk et al. (2011)	ND	Morningness-Eveningness questionnaire	Class times or teaching start time	F-test, $P < 0.001$	ND	CGPA
2	Din et al. (2012)	ND	Questionnaire	Information retrieval on the Facebook	χ^2-test, $P = 0.002$	ND	CGPA
3	Odeh (2012)	ND	- Questionnaire - Face-to-face interviews	Frequency usage of electronic resources	$r = 0.021$, $P = 0.703$	ND	GPA
4	Suad Al-Saud (2013)	Cross-sectional	VARK questionnaire	Learning styles	t-test, $P = 0.019$	ND	GPA
5	Nuzhat et al. (2013)	ND	VARK questionnaire	Learning styles	χ^2-test, $P > 0.05$	No significant sex difference in the academic performance	CGPA
6	Usman et al. (2014)	ND	Questionnaire	Internet addiction (IA)	$r = 0.01$, $P = 0.93$	No significant difference between sex in internet addiction	GPA
7	Almighal (2015)	Cross-sectional	VARK questionnaire	Learning styles	F-test, $P = 0.05$	Scores in female students were higher than in males	GPA
8	Al Shawwa et al. (2015)	Cross-sectional	Questionnaire	Time spend with friends (every day)	OR = 1.30, $P > 0.05$	ND	GPA
9	Paiboonsithiwong et al. (2016)	Cross-sectional	VARK questionnaire	Learning styles	F-test, $P = 0.797$	ND	GPA
10	Rashid and Asghar (2016)	Survey	Media and technology usage scale	Media and technology usage	$\beta = -0.08$, $P > 0.06$	ND	GPA
11	Halboub et al. (2017)	Cross-sectional	Self-administered questionnaire	Social networking usage	OR = 0.55, $P > 0.05$	ND	GPA
12	Ibrahim et al. (2018)	Cross-sectional	Problematic mobile phone use questionnaire	The frequently used mobile	t-test, $P = 0.001$	The mean mobile phone dependency score between males and females was significantly different	GPA
13	Yunita et al. (2018)	ND	Online questionnaire	Mobile phone usage (at class room ≥ 3 times)	$r = -0.036$, $P < 0.1$	ND	GPA at the 1st, 2nd year
14	Alamri (2019)	ND	Questionnaire	Students' perceptions toward social media usage	F-test, $P = 0.005$	ND	GPA
15	Li et al. (2019)	Survey	Data from campus smart card	Students' friendship network (Borrowing book, dormitory access, and library access data)	χ^2-test, $P < 0.01$	ND	GPA at the 2nd year
16	Alkhateeb (2020)	Survey	Questionnaire	The duration of use of social networks	$r = 0.247$, $R^2 = 0.061$, $P = 0.000$	ND	GPA
17	Bou-Hamad (2020)	Survey	Questionnaire	Usage of social media	$\beta = -0.611$, $P < 0.01$	ND	GPA
18	Mei et al. (2020)	ND	Card ID: library visit number	Library visit number	$r = 0.386$, $P < 0.001$	ND	GPA
19	Sumuha & Hawi (2020)	ND	The internet gaming disorder (IGD-20) test	Score of internet gaming disorder	$r = -0.179$, $P < 0.01$	ND	GPA

GPA: Grade Point Average; CGPA: Cumulative Grade Point Average; ND: no data

Table VI Studies demonstrating the relationship between learning environment and academic achievement

No.	Authors	Study design	Research instrument	Indicator	Statistic	Interaction with sex	Academic performance
1	Al-Ansari and El Tantawi (2015)	ND	The DREEM questionnaire (online questionnaire)	Students' perception of the learning environment	F-test, $P = 0.03$	ND	GPA
2	Chen (2015)	ND	Parental authority questionnaire	Parenting style score	F-test, $P < 0.05$	ND	GPA
3	Nouh et al. (2016)	Cross-sectional	The DREEM questionnaire (online questionnaire)	Students' perception of the learning environment	$\beta = 0.38$, $P < 0.001$	ND	GPA
4	Onchang and Hawker (2018)	ND	Noise exposure measurements	Community noise (traffic)	OR = 1.098, $P > 0.05$	ND	GPA
5	Jawad & Shalash (2020)	ND	E-learning strategy	E-learning strategy	t-test, $P = 0.000$	ND	GPA

GPA: Grade Point Average; ND: no data

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6. DISCUSSIONS

This systematic review identified five factors that affected academic achievement in the Asian educational setting. The reason for selecting the Asian setting instead of the global setting was to minimize the variation due to geographic, socioeconomic, and cultural differences. However, this also affects the external validity of this systematic review i.e. applying the result to the Western educational system should be performed with caution. In this review, we found multiple factors that positively affected GPA. The citations for non-Asian studies that supported our findings are provided. For demographic factors, performing physical activity was associated with a higher GPA [103]. Evidence supports that exercise is associated with IQ [104]. Besides, physical activity increases brain blood flow and might increase intelligence via this mechanism. Another explanation is that physical activity increases emotional intelligence and self-efficacy [105]. However, the consensus explanation for such an association is still unknown. Sex difference in GPA was also observed in this systematic review. However, the difference in intelligence between males and females is still debatable and more studies are still needed [106]. Positive psychological factors (EQ [54, 107, 108], grit [57], mental support [109], motivation [110], positive affect [111], satisfaction from faculty [63], self-efficacy [65, 112], self-perception [113], and study skills [114]) were found to improve GPA. Studies are demonstrating that positive psychology improved academic achievement [115, 116]. We also found that admission criteria (MMIs [117] and NCEE [76]) positively affected GPA. MMIs are reliable in assessing non-cognitive functions [118]. Since non-cognitive factors e.g. anxiety, self-efficacy [119], motivation [120] were positively associated with a higher GPA, MMIs may influence GPA via these non-cognitive attributes. Besides, studies observed the positive effects of learning-related daily habits (class times [121]), and learning environment (authoritative parenting style [122], and student perception of the learning environment [123]) on GPA.

We also identified factors that negatively affected the GPA. The citations are for the supporting non-Asian studies. Negative psychological factors (e.g. anxiety [124, 125], and negative emotions [126]) decreased GPA. This is not surprising and there is evidence showing the negative effects of negative moods on learning [127]. In fact, studies showed that brain development suffers from negative feelings [128, 129]. We also found that the relationship between the frequency of mobile usage and GPA were inconclusive. Several other studies supported the negative effects of frequent usage of mobile phones on GPA [26, 91, 130]. The negative effect may stem from the low life satisfaction and high loneliness of frequent phone users [131]. However, a study that found a positive relationship between phone usage and GPA stated that using phones increases metacognitive awareness, thus increasing GPA [132].

There were limitations in this systematic review. The data on academic achievement were assessed from GPA obtained from different sources e.g. questionnaires [31, 32, 42, 56, 59, 64, 69, 92, 133], and admission offices [79, 82]. The self-reported GPA could suffer from recall bias. Also using high school GPA to predict academic performance [78-80, 82] can suffer from between-school differences [134]. Another limitation of the study was the use of questionnaires which can introduce several types of biases to the original data. A study found that participants tend to positively respond to the questionnaire, and almost half of the results from questionnaires could be defective [135]. Besides, using questionnaires for psychological measurement e.g. reflective thinking questionnaire (RTQ) [62], self-efficacy questionnaire [64], standard cyber sharing emotional intelligence questionnaire [136], and State-Trait Anxiety Inventory (STAI) [70], can be subjective.

This systematic review of the factors affecting academic achievement has both academic and research implications. For academic implications, we found multiple studies investigating modifiable factors that affect academic achievement. Theoretically, positive factors, e.g., emotional and mental supports, parental guidance, physical activities, supportive class environment, and student friendship network, should be incorporated into learning and classroom management to improve the academic achievement of students. Further classroom research may be conducted to affirm the positive effects of the factors before the large-scale implementation of the related policy can be performed. Negative factors, when are known, can be avoided, or even negated by implementing related policies. For example, the policy to reduce noise pollution should be adopted in the university area to alleviate the negative effect of community noise. For the other factors that were not associated with GPA or the association was

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inconclusive, further research should focus on those factors to explore their application in education. We also suggest that future studies should focus on the relationship between academic achievement and career success which can be indicated using advancement expectations, career satisfaction, job attainment rates, occupational status, salary, and turnover intentions.

7. CONCLUSION

This systematic review identified the demographic factors, psychological factors, learning-related daily habits, admission criteria, and learning environment that were associated with GPA. More studies are required to ascertain the association between the aforementioned factors and GPA which is one of the most utilized surrogates for academic achievement.

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