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Self-Directed Learning, Academic Achievement and Motivation: A Meta-Analytical Study

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This study is a meta-analytical examination of the relationships between academic achievement, motivation, and self-directed learning. It aims to review scientific studies investigating how self-directed learning readiness relates to both motivation and academic achievement to find a common effect level and to synthesize the study results. According to the meta-analytical results, it can be seen that academic achievement increases in line with an increase in the level of self-directed learning readiness. The results reveal that the relationship between self-directed learning and both motivation and academic achievement, which are two important indicators of the educational process, constitutes an important structure. It is recommended that relational studies conducted at the K–12 level of the relationship between self-directed learning and motivation should be compared with the results of this study through a separate meta-analysis.

Cette étude est un examen méta-analytique des relations entre les résultats scolaires, la motivation et l'apprentissage autodirigé. Elle vise à passer en revue les études scientifiques portant sur la manière dont la préparation à l'apprentissage autodirigé est liée à la fois à la motivation et aux résultats scolaires, afin de trouver un niveau d'effet commun et de synthétiser les résultats de l'étude. Les résultats de la méta-analyse montrent que les résultats scolaires augmentent en fonction du niveau de préparation à l'apprentissage autodirigé. Les résultats révèlent que la relation entre l'apprentissage autodirigé et la motivation et les résultats scolaires, qui sont deux indicateurs importants du processus éducatif, constitue une structure importante. Il est recommandé que les études relationnelles menées au niveau M à 12 sur la relation entre l'apprentissage autodirigé et la motivation soient comparées aux résultats de cette étude par le biais d'une méta-analyse séparée.

The role of an educational institution today is not only to provide a good learning experience to students, but also to help them continue self-learning until they become accustomed to life-long learning. Looking through the lens of the 21st century, as futurist Toffler (1984) put it, tomorrow's schools must teach students how to process information. Students should learn to recognize out-of-date information, acquire up-to-date and accurate information, and then arrange the available information to form an information network. The skill of self-directed learning is one of the major indicators for whether students will be able to transform their learning skills into life-long practices. This study is conducted to provide the literature with the common effects of studies from different disciplines and geographies that have explored if adults are ready for self-directed

learning skills as well as the relationship that these skills have with motivation (internal and external) and academic achievement.

Self-Directed Learning

The concept of self-directed learning started to be discussed frequently in 1960s in the field of educational sciences (Hiemstra, 1994), and individuals who focused on learning to gain knowledge were referred to as *self-directed learners* (Brockett & Hiemstra, 1991; Derrick & Carr, 2003; Guglielmino et al., 2004; Halpern, 2003; Hiemstra, 1994; Merriam, 2001).

Since Houle's (1961) study of adult education in North America, self-directed learning has become one of the most debated and researched subjects. Self-directed learning contributes to playing an active role in the learning process, enhancing self-confidence, and gaining research and questioning abilities. Efficient self-directed learning requires knowledge of its method and readiness to learn. Self-directed learning also requires confidence in performing research, observation, and problem-solving activities and a high motivation to learn (Long, 2005). According to Demir and Doğanay (2009), learning is a process and requires the extensive use of self-direction skills. The process of self-directed learning involves evaluating what is known and unknown, selecting what is desired to be known, and finding a way to learn it. Since individuals organize their learning with cognitive awareness by interacting with the external environment, they become active participants in the knowledge generation process. With self-directed learning, individuals get involved in the processes of belonging, demanding, and discovering. Achieving this is a fair example of unstructured learning (Toprak & Erdoğan, 2012).

Self-directed learning involves many dimensions, the most important of these being the internal variable. The social or educational factor comes later (Canipe, 2001; Garrison, 1997). Brookfield (1984) attracted attention to the internal variable. Brookfield (1984) distinguished between learning, which is an internal transformation, and education, which is a method for managing the factors that affect that transformation. That is why he proposed conceptualizing the internal dimension of self-direction as self-directed learning and the process dimension as self-directed education. There must be an internal or cognitive dimension for self-directed learning; otherwise, it will focus on teaching, not self-directed learning (Long, 1989). The cognitive learning theory also emphasizes active participation in the learning process and accepting responsibility for the latter. In self-directed learning, learners are directly involved in the direction process, choosing their own actions and being aware of their control and responsibility (Levett-Jones, 2005; Linares, 1999; Lunyk-Child et al., 2001). Humanism, the behavioural approach, critical reflection theory, and constructivism are all approaches that affect self-directed learning. The goal of self-directed learning is to engage in and manage the learning process while being aware of the need to achieve the goals that have been set. The teacher's role is to provide options and materials so that learners can help themselves by taking responsibility and controlling the learning process.

The following eight elements mentioned by Mocker and Spear (1982) help individuals to get ready for self-directed learning:

1. Openness to learning opportunities,
2. Personality as an effective learner,
3. Learning initiative and independence,
4. Acceptance of informed responsibility,

5. Affection for learning,
6. Creativity,
7. Inclination toward the future,
8. Using basic working and problem-solving skills.

Iwasiw (1987) explained the self-directed learning process by placing it into five stages. According to the stages he set out, students identify their own learning needs, goals, and resources; define their strategies; and evaluate their product. Patterson et al. (2002) stated that six characteristics should be present in the self-directed learning process, namely the need to learn, being ready to learn, collecting information, managing information, critical thinking, and critical evaluation.

Candy (1991) modelled self-directed learning as a three-dimensional concept consisting of competence, resources, and rights when attempting to explain it based on the constructivist theory (Canipe, 2001). In Candy's model, competence includes determination, time-management, curiosity, critical thinking, self-evaluation, and rights; it refers to self-confidence in self-directed learning and consists of the internal dimension of self-directed learning. Libraries, data centres, laboratories, computers, documents, computer hardware, time, money, and employment, which help to develop self-directed learning skills, together comprise the resources dimension and relate to the process dimension of self-directed learning (Tarhan, 2005).

Long's (1989) self-directed learning model has three dimensions, namely the social dimension, which means independently performing tasks in the learning process; the educational dimension, which relates to the activities in the learning process; and the internal dimension, which corresponds to the cognitive status of the learner. The social and educational dimensions in Long's (1989) model constitute the process dimension of self-directed learning. Garrison (1997) argued that there are two dimensions of self-directed learning, namely self-direction and learning, and having criticized research in this area for dwelling only in the former dimension, while overlooking the latter, devised a new self-directed learning model.

Gültekin (2007) argued that gaining self-directed learning skills is one of the fundamental needs of people today and that adding new members to the group of independent learners who can identify, define, and learn learning needs should be a priority of the educational system. He also stated that self-directed learners can use relevant learning resources and manage the planning, implementation, and evaluation processes related to their education.

Self-directed learners have the power to decide on the knowledge in which they want to specialize (Robinson et al., 2020). Moreover, metacognitive skills are among the critical components of skills required for self-directed learning (Ghomi et al., 2016). Therefore, there is a link between self-directed learning and metacognition (Shih & Huang., 2018).

As a result of the expressions in the literature on self-directed learning and presented in this article, we can say that self-directed learning refers to students being aware of what they have learned, managing and defining projects to achieve their own goals, and creating new learning goals for themselves. It has also been established that there is another connection between metacognition and motivation, with Marulis and Nelson (2021) mentioning that metacognition, which is known to indicatively predict motivation (Alzahrani, 2022), positively relates to motivation.

Motivation

Motivation means taking action to do something. Someone who does not feel any impulse or inspiration to take action is considered unmotivated, whereas someone who has been inspired to take action toward a goal is said to be motivated (Ryan & Deci, 2000a). When used properly, motivation methods can reverse a lack of motivation, allowing action to be taken. Martin and Briggs (1986) defined motivation as a holistic process encompassing all internal and external circumstances that affect the origination, continuation, and control of a type of behaviour. Lack of motivation can be associated with undervaluing an activity, feeling a lack of self-sufficiency to take an action, or believing that an action will not produce the desired result; in other words, it is the lack of any internal or external desire or resource to perform work or a duty (Ryan & Deci, 2000b).

Intrinsic Motivation

Internal motivation is a kind of motivation to take action that develops in natural environments. Since this type of motivation involves a link between a person and a task, some researchers have defined internal motivation with respect to the task being interesting and others with respect to the satisfaction derived from the task by making a person take action internally to participate in that task (Deci & Ryan, 1981; Ryan & Deci, 2000a).

Internal motivation is gained through internal tendencies, such as the acquisition of a behaviour, learning, liking doing something, and pleasure, and not through coercion (Dede & Argün, 2004). An internally motivated individual performs activities freely and willingly without needing any reward or feeling under pressure (Deci et al., 1991). Internal motivation may be needed for different behaviours. It may be difficult to know what behaviours require one to have more internal motivation, since it manifests itself between the individual and the activity. Although a behaviour may be exhibited in connection with internal motivation in one individual, it may not be exhibited due to internal motivation in another (Ryan & Deci, 2000a). Satisfaction in internal motivation arises from the work itself, whereas satisfaction in external motivation occurs due to external means, such as material and verbal rewards (Gagné & Deci, 2005).

Extrinsic Motivation

External motivation is influenced by external stimuli to perform an activity in a desired way. These stimuli may include rewards, punishments, pressure, appreciation, and affection (Narmanlı, 2019). Individuals exhibit their behaviours mostly through internal motivation in their childhood, but in later years, as they understand social rules from the relationships around them, their behaviours based on internal motivation decrease, and they become obliged to act according to these rules. They then take actions linked with external motivation to avoid feelings of punishment or to be rewarded (Deci & Ryan, 2000). For students having external motivation, protection from the negative opinions of, for example, their teachers, family, or friends is essential (Middleton & Spanias, 1999).

Achievement

Academic achievement can be defined as the level of performance exhibited during education

(Jarvis, 1999) or a level of success as measured with a knowledge or skill test (Spafford et al., 1998); it can also be reflected by grades, degrees, and other certifications or by public approval and be defined as knowledge, competence, and the acquisition of a higher-level status (Collins & O'Brien, 2011). Individuals with a high level of academic achievement are responsible and success-focused persons who are disciplined; they think analytically and independently and have extraordinary thinking skills (Sığrı & Gürbüz, 2011). These individuals are aware that learned behaviours will not remain fixed; they can update them according to new circumstances and use their self-regulating learning strategies (Zimmerman & Martinez-Pons, 1990). It is generally agreed that grade point average (GPA) is an indicator of academic talent, performance, and achievement (Bean, 2005). McGrath and Braunstein (1997) stated that GPA is among the most effective variables for showing the continuation of a behaviour.

This study aims to review scientific studies investigating the relationships between self-directed learning readiness and both motivation and academic achievement to find a common effect level and synthesize the studies' results. To this end, it seeks answers to the following questions:

1. Is there a significant correlation between self-directed learning readiness and academic achievement?
2. Is there a significant correlation between self-directed learning readiness and motivation?
3. Does the relationship between self-directed learning readiness and academic achievement differ according to the following moderator variables: (a) the subject studied, (b) the type of publication, (c) the continent where the research was conducted, and (d) the year in which the study was conducted?
4. Does the relationship between self-learning readiness and motivation differ according to the following moderator variables: (a) the subject studied, (b) the type of publication, (c) the continent where the research was conducted, and (d) the year in which study was conducted?

Method

This research study employed a meta-analytical method. A meta-analysis is defined as the grouping of apparently similar studies conducted on a particular topic according to specific criteria and combining the quantitative findings pertaining to the studies (Dinçer, 2014). Cohen et al. (2007) described meta-analysis simply as the "analysis of analyses." In this research, studies investigating the relationships of self-directed learning readiness with motivation and academic achievement were identified and then analysed using the meta-analytical method.

Data Collection

The studies within the scope of this research were identified through a search of keywords related to the research, such as self-directed learning, motivation, and academic achievement. The studies were found from scientific databases including that of the Council of Higher Education (CoHE), the National Thesis Search System, ProQuestCitations, Google Academic, EBSCO, ERIC, Web of Science (WOS), PubMed, and Science Direct. The following were the criteria for the studies' inclusion:

- The studies were conducted between 2000 and today;
- The studies investigated the relationship between self-directed learning readiness and motivation or academic achievement;
- In analyses exploring the relationship between variables such as correlation, regression, and path analysis, the following were present: (a) the level of correlation (r coefficient), (b) the number of participants (n), and (c) the dimension of correlation (positive/negative);
- The studies included information on the subject/area being studied, the type of publication, the geographical region where the study was conducted, and the year of conducting the study;
- The studies used self-directed learning scales prepared with an andragogical approach, since our target group was adult learners. The following scales were used: *Self-Directed Learning Readiness Scale* (also known as Learning Preferences Assessment) developed by Guglielmino (1977), the *Oddi Continuing Learning Inventory* developed by Oddi (1986), the *Self-Directed Learning Readiness Scale* and *Self-Directed Learning Readiness Scale/NE* developed by Fisher et al. (2001) and Fisher and King (2010), and the *Self-Rating Scale of Self-Directed Learning* (SRSSDL) developed by Williamson (2007).

Data Analysis

A coding key was prepared to identify the studies to be included in the research. The study number, correlation (r) value in the study, direction of the correlation (positive/negative), number of participants (n), author(s), subject/topic of the study, year and place, and type of publication were entered into the coding key. Data from the studies that met the inclusion criteria were transferred to the statistical software, and the analysis was carried out. A meta-analysis is an analysis that focuses on effect size. The effect sizes of individual studies are converted into a common effect size, for which precision is important. Precision is influenced by variations, standard error, confidence interval, whether the samples in the studies are homogeneous or not, sample size, saturation, and study models (Borenstein et al., 2009). Different scales were used in the studies included in the research. For this reason, the random-effects model was preferred for calculating effect sizes.

The Q statistic is important for the selection of a fixed- or random-effects model. When the significance value (p) resulting from the Q statistic is found to be significant, this is interpreted as "not all studies share the general effect." This means that the studies are heterogeneous in themselves (Borenstein et al., 2009; Hedges & Olkin, 1985). Additionally, an I^2 value is obtained as a result of the analysis that shows heterogeneity as a percentage. For this reason, the Q and I^2 values were examined in the research. A funnel plot was used for observing publication bias. A symmetrical image obtained in the funnel plot indicates that there is no publication bias. When the studies included in the meta-analysis are grouped in the inner parts and edges of the plot, the studies are proven to have a large contribution to the common effect size. When there is an asymmetrical image of the gathered studies in the plot, with them grouped in a corner, it indicates publication bias (Cooper et al., 2009). In this research, the studies were reviewed with a funnel plot and their contribution to the common effect size in the meta-analysis was assessed.

Moderator analysis enables identification of the direction of the differences between the subgroups and the differences between the average effect sizes of the variables (moderators;

Littell et al., 2008). The statistical significance of the difference between the moderator variables is tested using the Q statistic (Hedges & Olkin, 1985). In this method, Q is divided into two as Qbetween (Q_b) and Qwithin (Q_w), and these two different Qs are analyzed. Q_w tests the homogeneity in the moderator variable itself, and Q_b the homogeneity between the groups (Borenstein et al., 2009; Hedges & Olkin, 1985). In this research, the subject/area being studied, the type of publication, the geographical region where the study was conducted, and the year of conducting the study were studied as the moderator variables.

Results

The characteristics of the studies within the scope of the meta-analysis were reviewed and are presented in Table 1.

Of the 23 studies included in the meta-analysis that investigated the relationship between self-directed learning readiness and achievement, seven were of health sciences, three of social sciences, four of educational sciences, and three each of applied sciences and online courses; a further three studies did not mention their study area. All studies were conducted at the higher education level; of them, 12 were reported as articles and 11 as theses. Of the studies, 11 were conducted in the USA, five in Central Asia, five in the rest of Asia, one in Africa, and one in Europe;

Table 1

Characteristics of the Studies

Variable	Self-Directed Learning and Achievement Relationship	Self-Directed Learning and Motivation Relationship
	n	n
Study Subject/Area		
Health Sciences	7	12
Social Sciences	3	5
Educational Sciences	4	0
Applied Sciences	3	0
Online Courses	3	0
Unknown	3	0
Publication Type		
Article	12	16
Thesis	11	1
Region of Study		
USA	11	1
Middle Asia	5	4
Asia	5	12
Africa	1	0
Europe	1	0
Year of Study		
2014 and Before	13	2
2015 and After	10	15
Total Number of Studies	23	17
Total Number of Persons Reached via Studies	5097	4842

13 were conducted in 2014 or earlier and 10 in 2015 or later. (The intensity of the studies obtained within the scope of the research and included in the meta-analysis was examined according to the year. To have a balanced distribution by the researchers, the studies were separated into 2014 or earlier and 2015 or later.) Through the studies investigating the relationship between self-directed learning readiness and achievement, 5097 individuals were reached.

Of the 17 studies investigating the relationship between self-directed learning readiness and motivation that were included in the meta-analysis, 12 were on health services and five were on social sciences. All studies were conducted at the higher education level. Of these studies, 16 were reported as articles and one as a thesis; one was conducted in the USA, four in Central Asia, and 12 in Asia; and two were conducted in 2014 or earlier and 15 in 2015 or later. Through the studies investigating the relationship between self-directed learning readiness and motivation, 4842 individuals were reached.

Relationship Between Self-Directed Learning Readiness and Academic Achievement

The studies were found to be heterogeneous ($Q_{(22)}$ = 1090,877, $p < .05$), and their effect size was calculated. The assumption that the studies differed from each other was verified by the result of the Q statistic being significant. The level of heterogeneity in the studies was found to be 98% (I^2 = 97.983%). According to Cooper et al. (2009), the value of I^2 being over 75% shows a high level of heterogeneity. The effect size calculated using the random-effects model in the research and the weights of the studies in the meta-analysis are presented in Figure 1.

When the effect sizes of the studies used in the research were reviewed individually, it was found that some of the studies had very large and significant effects in favour of negative

Figure 1

Forest Plot of the Relationship Between Self-Directed Learning Readiness and Academic Achievement

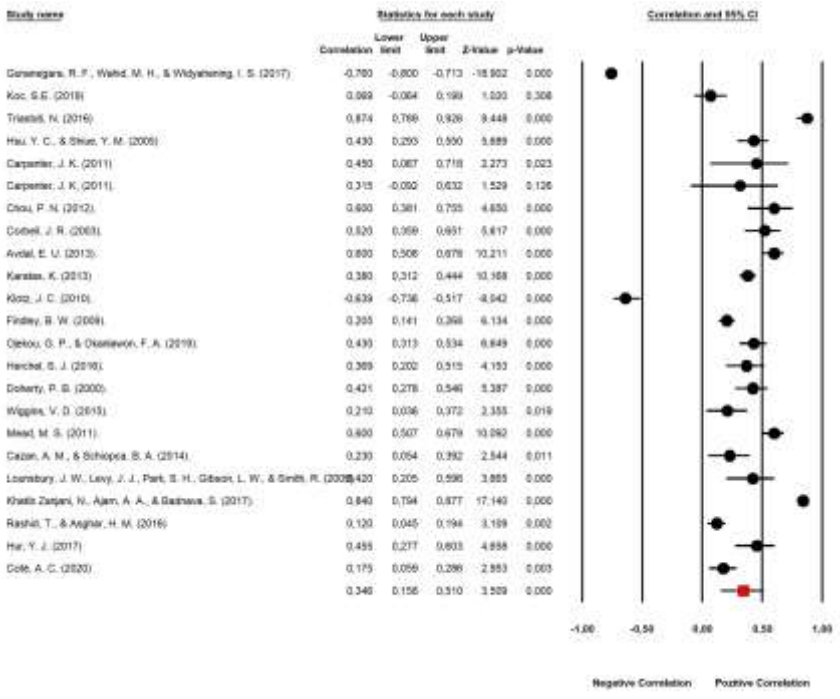


Table 2

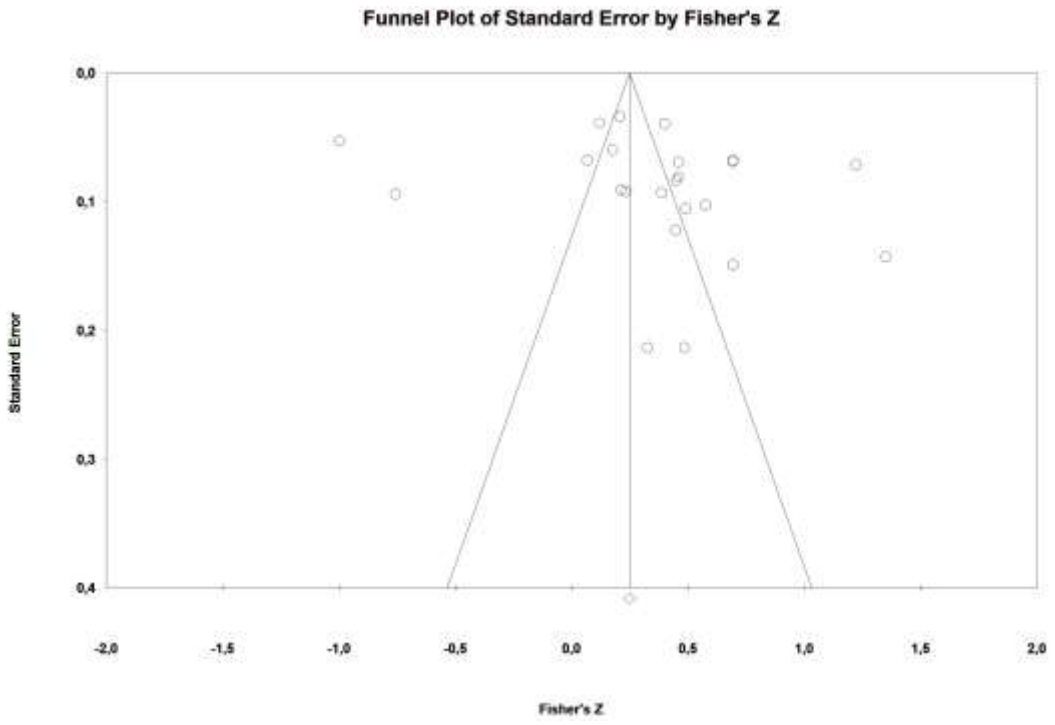
Results of Meta-Analysis Effect Size Calculated with Random Effects Model

Effect Size	Z	Q	I^2	Effect Size 95% CI	
				Lower	Upper
0.346	3.509***	1.090.877***	97.983	0.158	0.510

*p<.05, **p<.01, ***p<.001

Figure 2

Review of Publication Bias



correlation (Gunanegara et al., 2017; Klotz, 2011). In contrast, the studies of Khatib Zanjani et al. (2017) and Triastuti (2016) had a significant effect size in favour of positive correlation. Figure 1 shows the weights and individual effect sizes of the studies used in the research. The results of the meta-analysis made with the random-effects model are shown in Table 2.

The mean effect size, which was found to be 0.346 and positive, was significant (Z = 3,509, p < .05). Therefore, it can be said that the relationship between self-directed learning readiness and academic achievement was in favour of positive correlation. An interpretation of this is that academic achievement increases with increasing levels of self-directed learning readiness. The funnel plot publication bias is presented in the funnel plot in Figure 2.

In Figure 2, the two sides of the funnel plot are not symmetrical, and there are too many studies on the right side for there to be symmetry, which is an indication of publication bias. To establish symmetry, the studies in Duval and Tweedie (2000) needed to be dragged from one side of the plot to the other by the "cut and paste" method; thus, eight studies had to be dragged to the other side. The new common effect size obtained by the cut and paste method was 0.129.

Relationship Between Self-Directed Learning Readiness and Academic Achievement—Moderator Variables

The studies investigating the relationship between self-directed learning readiness and achievement were reviewed to see if there were differences between them with respect to the subject/area being studied, the type of publication, the geographical region where the study was conducted, and the year of conducting the study. The results are shown in Table 3.

None of the moderator variables of the study subject/area, the type of publication, the region where the study was conducted, and the year of study were found to create any significant difference (Q_b = 2,917; Q_b = 0,501; Q_b = 5,038; Q_b = 0,018, respectively; $p > .05$).

Relationship Between Self-Directed Learning Readiness and Motivation

The studies were found to be heterogeneous ($Q_{(16)}$ = 397,591, $p < .05$), and their effect sizes in the research were calculated. There was 96% heterogeneity in the studies (I^2 = 95.976%). The effect size calculated using the random-effects model in the research and the weights of the studies in the meta-analysis are presented in Figure 3.

When the effect sizes of the studies used in the research were reviewed individually, it was found that some of the studies had very large and significant effects in favour of positive correlation (Grandinetti, 2013; Triastuti, 2016). Figure 3 shows the weights and the individual effect sizes of the studies included in the research. The results of the meta-analysis using the random-effects model are presented in Table 4.

The mean effect size was significant (Z = 8130, $p < .05$) and found to be 0.544 and positive.

Table 3

Results of Meta-Analysis Effect Sizes Calculated by Random Effects Model (Moderator Analysis)

Moderator Variable	Levels of Moderator Variables	n	Effect Size	Z	$Q_{between}$ (Q_b)
Study Subject/Area	Health Sciences	7	0.473	1.817	2.917
	Social Sciences	3	0.420	6.284***	
	Educational Sciences	4	0.358	3.545***	
	Applied Sciences	3	0.304	2.325*	
	Online Courses	3	0.318	3.584***	
	Unknown	3	-0.034	-0.092	
Publication Type	Article	12	0.408	2.263*	0.501
	Thesis	11	0.275	3.022**	
Region of Study	USA	11	0.278	2.736**	5.038
	Middle Asia	5	0.461	2.796**	
	Asia	5	0.376	0.853	
	Africa	1	0.430	6.649***	
	Europe	1	0.230	2.544*	
Year of Study	2014 and Before	13	0.358	4.116***	0.018
	2015 and After	10	0.331	1.687	

*p<.05, **p<.01, ***p<.00

Therefore, it can be said that the relationship between self-directed learning readiness and motivation was in favour of positive correlation. This can be interpreted as academic motivation increasing with rising levels of self-directed learning readiness. The publication bias is presented in the funnel plot in Figure 4.

Some of the studies included in the meta-analysis on the relationship between self-directed learning readiness and motivation were seen to group at the tip and the outer part of the funnel plot. This shows that the contributions of the studies included in the analysis were somewhat low. The two sides of the plot were not symmetrical; there were too many studies on the left side to maintain the symmetry. To establish symmetry, eight studies needed to be dragged to the other side. The new common effect size obtained using this method was 0.658.

Relationship Between Self-Directed Learning Readiness and Motivation—Moderator Variables

The studies investigating the relationship between self-directed learning readiness and motivation were reviewed to see if there were differences between them with respect to the subject/area being studied, the type of publication, the geographical region where the study was conducted, and the year of conducting the study. The results are summarised in Table 5.

Figure 3

Forest Plot of the Relationship Between Self-Directed Learning Readiness and Motivation

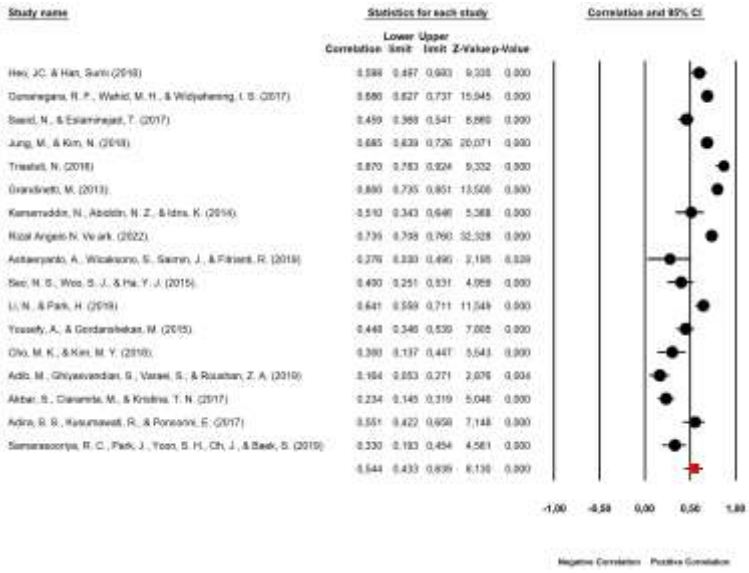


Table 4

Results of Meta-Analysis Effect Size Calculated by Random Effects Model

Effect Size	Z	Q	I^2	Effect Size 95% CI	
				Lower	Upper
0.544	8.130***	397.591***	95.976	0.433	0.639

*p<.05, **p<.01, ***p<.001

The effect size did not create any significant difference in the moderator variables of the study area/subject and the study year (Q_b=0,490; Q_b=0,826, respectively; $p > .05$). The type of publication moderator variable of the studies created a significant difference ($p < .05$). One study was reported as a thesis, and the effect size obtained from it was significantly higher than those of the studies reported as articles. The region where the study was conducted created a significant difference in the effect size ($p < .05$). The effect size of a study from the USA was the highest, and the studies conducted later on in Central Asian countries also had high effect sizes. The lowest effect sizes were found in the studies conducted in Asia.

Figure 4

Review of Publication Bias

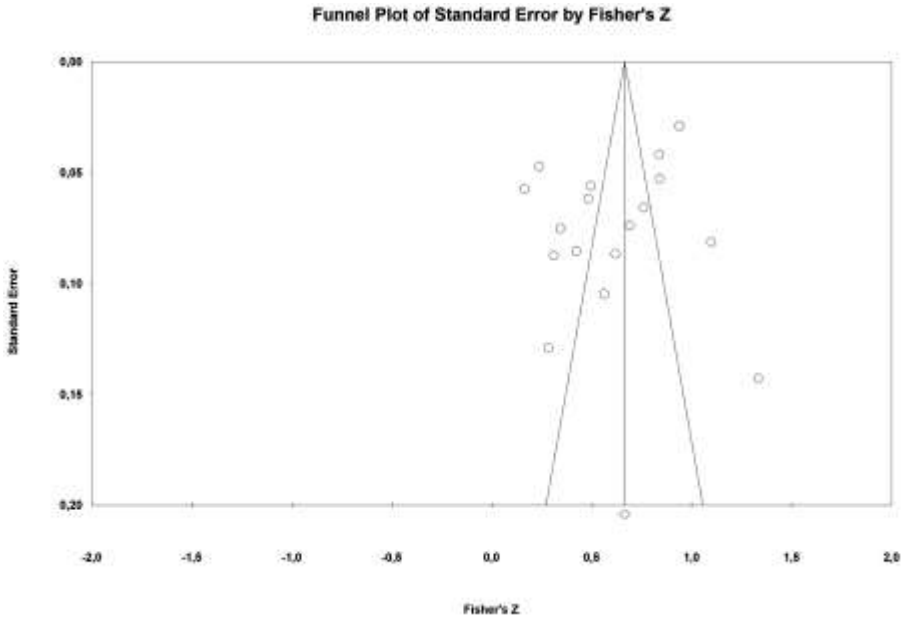


Table 5

Results of Meta-Analysis Effect Sizes Calculated by Random Effects Model (Moderator Analysis)

Moderator Variable	Levels of Moderator Variables	n	Effect Size	Z	$Q_{between}$ (Q_b)
Study Subject/Area	Health Sciences	12	0.527	5.547***	0.490
	Social Sciences	5	0.589	9.193***	
Publication Type	Article	16	0.522	7.631***	21.723***
	Thesis	1	0.800	13.500***	
Region of Study	USA	1	0.800	13.500***	21.337***
	Middle Asia	4	0.536	7.241***	
	Asia	12	0.480	2.765**	
Year of Study	2014 and Before	2	0.638	3.116**	0.826
	2015 and After	15	0.523	7.327***	

*p<.05, **p<.01, ***p<.001

Discussion and Suggestions

This study found that self-directed learning is a significant structure for adult learners by revealing that with higher levels of self-directed learning, both academic achievement and motivation also increase. The relationships between self-directed learning and academic achievement and motivation had a strong effect size (Cohen, 2013; Green & Salkind, 2013). Therefore, conducting further studies on self-directed learning and education-teaching activities to help students gain self-directed learning skills seems to be an important matter.

Alsufyani et al. (2019) reported that self-directed learners can reach high levels of motivation, since they are motivated to develop themselves and intend to continue their education. It can be said that the significant difference created by the region where the study was conducted in the effect size obtained was due to the undeniable role of culture in learning (Loh & Teo, 2017). Learning styles are generally based on culture and there are different types of learning, thinking, and behavioural patterns that influence learning in students of different cultures (Bryson, 2007; Zhu et al., 2008). Education system policies in different countries may also have a major impact on the learning of students (Colodro-Conde et al., 2015).

Publication bias is one of the major methodological problems in meta-analyses and study reviews (Castro et al., 2015; Duval & Tweedie, 2000; Peters et al., 2006). Most of the effect sizes studied in this meta-analysis consisted of studies published in prestigious scientific journals. To remove the effect of publication bias on effect size, the studies of Duval and Tweedie (2000) were moved from one side of the plot to the other by way of cut and paste, a correction that established the symmetry.

Academic achievement and motivation are important components of education, and it can be said that as the level of self-directed learning readiness increases, so too will students' academic achievement and motivation increase. In this way, even if the formal education ends, students with such a high level of self-directed learning are assumed to have acquired the skills and motivational resources to continue their learning. Therefore, designing teaching activities to increase students' levels of self-directed learning readiness will not only allow them to gain permanent learning experiences during their formal education but also enable them to gain the characteristics that will prepare them for a life-long learning process. These students, who are inspired for life-long learning during the period of their formal education, will also question their expectations and choices in relation to the future and identify what their learning outcomes needed in the period of formal education should be and will try various ways to attain these outcomes and more.

Since our target group was adult learners during our literature search, studies that were conducted using scales prepared with an andragogical approach were mostly included in the meta-analysis. However, it is known that there are many different self-directed learning readiness scales that have been developed with a pedagogical or an andragogical approach. We know that all adult learners have a pedagogical past. Many adults may also have acquired their self-directed learning skills in this pedagogical education period. For this reason, there is a need for quantitative and qualitative studies using self-directed learning scales prepared in line with pedagogical principles. It was seen that most of the studies investigating the relationship between motivation and self-directed learning in particular were conducted in the area of health sciences. When viewed through the lens of the 21st century, as futurist Alvin Toffler (1984) put it, tomorrow's schools must teach how to obtain and synthesize current and accurate information. A student should be able to learn how to learn. Therefore, self-directed learning skills should not be

used in the area of health sciences alone, but all future life-long learners should benefit from it as a requirement for the coming centuries.

Since one of the characteristics of self-regulated learners is self-management, providing students with self-regulated learning experiences at an early age will enable them to gain self-directed learning skills, which they will need as their age advances. With the Covid-19 pandemic, many students were also engaged in online education/learning experiences within the scope of emergency online education. Studies on online learning platforms and adults participating in massive open online courses have revealed that the self-directed learning skill is one of the characteristics that should be owned by students on online learning platforms (Bonk et al., 2015; Morris, 2019; Stephen & Rockinson-Szapkiw, 2021; Zhu, 2021; Zhu & Bonk, 2019).

Within the scope of our research, only studies of adult learners were examined. For this reason, it is recommended that the relational studies conducted at the K–12 level on the relationship between self-directed learning and motivation should be compared with the results of this study through a separate meta-analysis. In addition, only relational studies were considered in this study. It is recommended that experimental studies examining the effect of motivation on self-directed learning in adult learners be conducted as a separate meta-analytical study.

Limitations

One of the limitations of this study is that it includes only correlational studies. The scales used by the included studies for self-directed learning were those of Fisher et al. (2001), Fisher and King (2010), Guglielmino (1977), Oddi (1986), and Williamson (2007). However, we see it as a limitation that we did not make the same inclusion criteria for motivation scales in the studies included in this study. The fact that only studies of adult learners were analysed within the scope of our research can be accepted as another limitation.

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