Promoting Self-Regulation in Higher Education: A Literature Review

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Abstract. Background. The problem of mental health and the length of time for graduation from students can be overcome with the ability to self-regulate. Self-regulation has a role for the study success of higher education students. Self-regulation can affect academic performance (GPA and other achievements), persistence, and anticipating procrastination behavior and academic delays. Self-regulation also affects the ability to adapt to various learning methods (offline, online, or blended learning). Not only being a predictor of academic achievement, self-regulation is also a predictor of one's success at the beginning of a professional career. **Objective.** This study aims to identify the factors of self-regulation and ways to increase self-regulation behavior of higher education students. **Method.** A literature review was conducted by searching bibliographies through ResearchGate and PubMed, using the keywords: self-regulation in higher educations and factors of self-regulation in higher educations. **Results.** Eight manuscripts were found which were comprehensive and relevant to the study objectives. The backgrounds of the students who were the respondents for these eight manuscripts were from universities in Belgium, Spain, Russia, Brazil, the Netherlands, Iran, New Zealand, and Romania. **Conclusion.** There are several factors that were found to have a significant correlation with self-regulation, namely: learning patterns, critical thinking, conceptions of feedback, peer feedback, autonomous motivation, perceived autonomy support, academic year, age, and type of higher education. Then there are a number of interventions that can be given to improve self-regulation, namely: life narrative reflection, peer feedback and chatbot.

Key Words. Self-regulation, higher education, study success, literature review, students, factors, interventions

INTRODUCTION

Higher education is the highest level of formal education as a place for scientific growth as well as preparing its users (namely students) to enter the world of work or complete the skills needed for career development and to become part of a prosperous society. Welfare in the context of society is seen from the extent of resilience, capacity to act, and readiness to face challenges (1). Well-being is part of mental health (2).

Some students actually have obstacles to get these benefits for several reasons. More than 60% of students of higher education in the US experience mental health problems in 2020-2021 (3). This survey was conducted on more than 350,000 students from 373 campuses. Each of these students experienced at least one mental health criterion.

The results of a 2020 survey of undergraduate students at Arizona State University, United States showed that there was a delay in graduation of 13% of all students (4). There are also students who do not continue their studies at 11% at the campus. There are 602,208 students in Indonesia out of 8,483,213 people (7%) who have dropped out of college (5).

One of the skills to deal with these problems is to use self-regulation. Mental health in a general context can be improved by self-regulation (6,7). Self-regulation can overcome procrastination behaviour and reduce graduation delays in the context of higher education (8,9). Self-regulation can overcome procrastination behaviour and reduce late graduation. Not only late graduation, self-regulation is a predictor of academic achievement as indicated by GPA (8,10–12). The increase in GPA and faster graduation time may also be related to students' adaptability to various learning methods in the classroom (offline, online, or a combination of both) which are influenced by self-regulation (8,13). Self-regulation benefits the various skills required for study.

Self-regulation is beneficial for the development of general skills of students in addition to academic skills such as the ability to make important decisions (12). Students also become more courageous in facing the transition from college to work and a continuous learning character is formed (14). Success in the early years of a student's professional career is also predictable by the level of self-regulation (12). Knowing the dynamics of these skills in students who have the potential to experience delays in graduation can be very important knowledge for educational development. The objective of this study is to identify the factors of self-regulation and interventions to increase self-regulation behavior of higher education students.

METHODS

This writing method is literature review. The writing consists of an introduction, research methods, discussions, and conclusions (15). A literature review was conducted by searching bibliographies through ResearchGate, PubMed, and Google Scholar. The keywords used are "self-regulation in higher educations" and "factors of self-regulation in higher educations".

The author performs several stages to find a journal that fits the theme. A total of 232 titles of journal articles were scanned online in September 2022. Based on the appropriate titles, 45 journal articles were downloaded. Found 14 journal articles that only discuss one type of self-regulation so that the articles were eliminated. Finally, 23 journal articles were eliminated because they did not discuss factors or interventions that could affect self-regulation. The authors used eight journal articles as the main articles for discussion. Several additional journals were used to provide an explanation of the discussion of the eight articles. Literature review was carried out until November 2022.

This paper reviews theories and research on how to increase self-regulation. The factors of self-regulation are discussed to understand the inter-factor dynamics of self-regulation. It also discusses interventions that are proven to increase self-regulation. Then the dynamics of these factors and interventions will be discussed at the end of this article.

DISCUSSIONS AND FINDINGS

This article will elaborate ways to increase self-regulation. This section will be divided into three parts. The first part of the discussion elaborates the definition of self-regulation based on the results of reviews of journal articles and other sources. The second part elaborates the factors of self-regulation in the context of higher education, analyses the ideas of each factor, and the dynamics of the relationship between the ideas of these factors. The last part elaborates interventions to improve self-regulation based on the results of the review and related to the factors previously discussed.

SELF-REGULATION DEFINITION

Self-regulation is the process of determining goals to be achieved by oneself and directing behaviour and cognitive processes to achieve these goals (16). High performance levels become possible with knowledge and skills of self-regulation. Effective self-regulation, in an educational context, is highly dependent on achieving goals by aligning cognitive, affective, and metacognitive learning strategies (17).

There is a recursive three-stage cyclical process of self-regulation (18). First, *forethought*, namely goal setting and planning by understanding perceptions and knowledge related to the task, context, and the self in relation to the task. Second, *performing tasks*, namely implementing strategies that have been prepared and monitoring how far they have moved closer to the goals and adjusting strategies as far as needed. Finally, *evaluation* is reflecting on the progress of whether it has reached the goal as information so that further planning can be made.

SELF-REGULATION FACTORS

In the following, the factors that influence the level of self-regulation in higher education students are discussed. It was found that there was a pattern that seemed to be interconnected among these factors. An explanation of each factor and the dynamics of these factors is the opening for this discussion.

Gender

Gender differences have no relationship with self-regulation in the following studies (19,20). The gender factor placed at the beginning is actually as additional information because it often appears as a demographic factor studied in various studies. There are important insights found in studies of gender relations and self-regulation.

The absence of gender differences in some of these studies may be due to higher education nowadays being increasingly egalitarian (20). There is not enough pressure to create gender stereotypes. Self-regulation below will explain that one of them is influenced by personal freedom which will be discussed in the academic motivation factor. This factor at least still needs to be considered as an indicator that higher education still maintains justice in providing behaviour to students.

Academic year and age

According to Herrera Torres and colleagues research, Academic year is a self-regulation factor with age as a mediator. In this study, there was no significant relationship between academic year and self-regulation (20). Academic year only has a negative correlation with one aspect of self-regulation, namely learning strategies. The higher the academic year, the lower the use of learning strategies. Students use various learning strategies more intensely in the early years of their college.

The age factor has a significant negative correlation on the use of self-regulation. The older the students, the use of learning strategies also decreases. Not only learning strategies, students are less intense in organizing the study process in higher education. Herrera's study used a sample with an age range of 16 to 56 years. The age gap is due to the large sample of students who have worked before studying in addition to students who are fresh graduates from the previous level. College is a support for their work.

Another study found that the use of self-regulation strategies will be very strong at the beginning of the school year and nearing graduation (12). This shows that self-regulation is increasingly needed when individuals experience a transitional period in life. The beginning of college is a period that requires intensive adaptation. The period before graduation demands preparation in various aspects of life. At this stage, individuals are forced to regulate themselves.

These two studies complement each other. Students need an adaptation process at the beginning and then get used to the situation so that there is a decrease in the use of self-regulation in the following years. Students who want to prepare themselves for the next career level will experience a transitional period in life so that they are forced to use self-regulation. There are also students who, on the other hand, do not experience a transitional period before graduating, as in Herrera Torres and colleagues research (20). Some of the research samples are students who have worked since before entering college. So that the older age indicates the longer the work experience experienced so that the stress to adapt to new things is getting smaller.

Type of institute

The research of Herrera Torres and colleagues (20) also found that different types of institutions of higher education (IHE) had an effect on student self-regulation. The findings of this study with a sample of three institutes in Brazil show that private IHE has students with higher self-regulation than public IHE. This finding cannot be generalized because the sample size is not representative of all IHEs in Brazil. It is necessary to see what indicators distinguish the quality of each IHE in this study.

What makes each IHE different is student satisfaction with infrastructure and student satisfaction with teaching-learning processes. Satisfaction with infrastructure is assessed from technological resources, technology and information support, as well as other student learning support facilities that are considered satisfactory by students. Satisfaction with teaching-learning processes in terms of student satisfaction with the quality of teaching they receive and the use of technological resources by the teacher. The role of the teacher in student self-regulation can be better understood through the factors discussed below.

Critical thinking

The definition of critical thinking can be seen from Bloom's taxonomy theory (21). Critical thinking is the mastery of various skills to deal with situations that have never been experienced. These skills are skills in Bloom's taxonomy pyramid from the most basic is knowledge, then comprehension, application, analysis, synthesis, to the very top is evaluation.

Halpern defines critical thinking as the process of defining the expected results and achieving these results by using cognitive abilities and strategies (22). Critical thinking is the process of thinking by making inferences and making decisions to predict outcomes and perform problem solving. Bagheri and Ghanizadeh research uses two

subcomponents of critical thinking, namely inference-making and deduction - as the logic of making conclusions and decisions - based on this definition (19).

Inference-making is the skill of drawing conclusions through the process of combining various clues with the background knowledge that the individual has (23). The clues that are often do not explicitly show the right conclusion, it requires the ability to assemble a clue puzzle with prior knowledge like a detective. Deduction is the process of building an argument using premises that can prove that the conclusion can be accepted rationally (24). There is research in the context of English as a Foreign Language (EFL) education which finds that critical thinking is a strong positive predictor of self-regulation (25). Similar research also shows a correlation between critical thinking and self-regulation, especially in the self-monitoring component (19). Statistically the correlation is in the form of positive interrelationships between inference-making, deduction and self-monitoring.

Based on Bagheri and Ghanizadeh review of various studies, individuals doing cognitive reflection need cognitive strategies such as self-monitoring (19). Self-monitoring is a metacognitive strategy of self-regulation which is the basis of improving the learner's reflection ability (26). Critical thinking helps the self-monitoring process to evaluate the thoughts and values held by individuals. Critical reasoning skills are needed so that self-reflection through the process of evaluating values becomes more relevant to experience. Thus, individuals can grow and develop optimally independently when there is a strong relationship between critical thinking and self-regulation. Further interaction between critical thinking and self-regulation can be found in the discussion of the next factor, namely learning patterns.

Learning Patterns

Learning patterns are patterns of behavioral components, beliefs, and motivations in learning that are not innate and can change (27). There are four dimensions in learning patterns (28) namely: processing strategies, regulation strategies (self-regulation, external regulation and lack of regulation), learning orientations (personally interested, certificate oriented, self-test oriented, vocation oriented, ambivalent) and conceptions of learning. This learning patterns model shows the relationship between the four dimensions (figure 1). Regulation strategies, learning orientations, and conceptions of learning have a reciprocal relationship (29). Processing strategies are only directly and reciprocally related to regulation strategies.
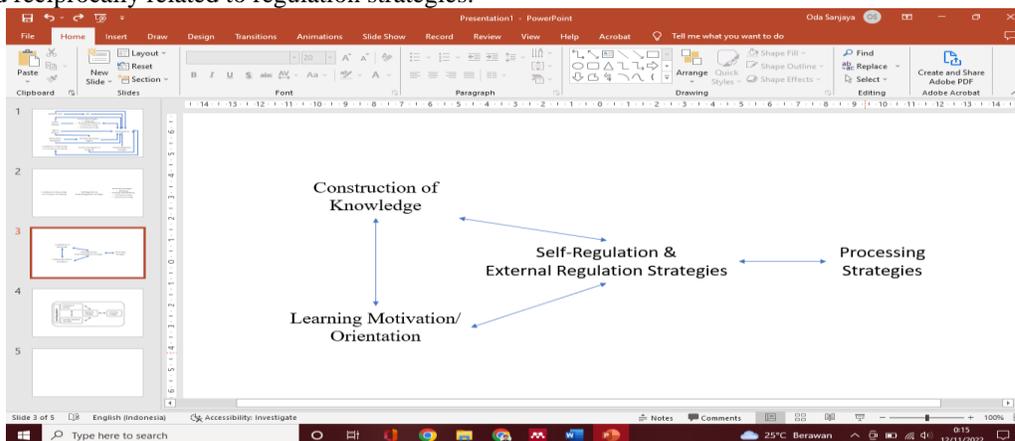

Figure 1. A learning patterns model of student learning (29)

Processing strategies is a dimension that contains aspects of critical thinking. The following is an explanation of the sub-dimensions of processing strategies (30) and the author's review regarding its relation to critical thinking:

- Stepwise processing, includes two more subs namely:
  - Memorizing and rehearsing: Learning about definitions, facts, lists of characteristics and the like by rehearsing them. This subdimension describes the knowledge level skills of critical thinking.
  - Analysing: Learning of separate elements thoroughly, in detail, gradually, and one by one. This subdimension is similar to the skill level analysis of critical thinking.
- Deep processing, includes two subs, namely:
  - Relating and structuring: connecting learned elements to each other and relating them to prior knowledge; organize these elements into a single flow of understanding. These subdimensions are similar to inference-making skills in comprehensions.

- o Critical processing: forming an original point of view on what is being studied, drawing conclusions from a personal point of view, and being critical of the conclusions of others. This subdimension is similar to the analysis and evaluation skills of critical thinking.
- Concrete processing: Concrete and apply what is learned by relating it to personal experience and by putting what has been learned into practice. This subdimension is similar to the comprehension and application skills of critical thinking.

Thus, processing strategies is a form of critical thinking. The way processing strategies relate to self-regulation is discussed in the interaction between dimensions in learning patterns.

The four dimensions of learning patterns (processing strategies, regulation strategies, conceptions of learning, learning orientations) and their sub-dimensions interact with each other to form four groups of sub-dimensional combinations (30,31). These four groups are labeled as four types of learning patterns. The following is an explanation of each type of learning patterns and in what patterns give rise to self-regulation.

1. *Undirected learning pattern* is characterised by an ambivalent learning orientation, an inherent conception of learning in collaboration with fellow students (cooperative learning) and stimulating education, and a lack of regulation.
2. *Passive idealistic learning pattern* is characterized by most of the sub-dimensions of learning conceptions (construction of knowledge, intake of knowledge, and use of knowledge) and two sub-dimensions of learning orientations (self-test oriented and vocation oriented). There is no imposition on the sub-dimension of processing or regulation. Students with this type of pattern are busy exploring their conception of what learning is and attach great importance to collaboration with other students.
3. *Reproductive-directed learning pattern* is characterized by the tendency to take information without selecting it and memorize it separately. The sub-dimension of this pattern consists of memorising and rehearsing, analyzing, external regulation of processes and results, intake of knowledge as mental model of learning, and certificate and self-test-directed learning orientations. There is no setting the burden on self-regulation strategies.
4. The only type that uses self-regulation is the *active meaning-directed learning pattern*. This pattern is characterized by the use of deep strategies to understand something, process it critically, relate it to their own experiences, and direct the learning process especially to themselves. Active meaning-directed tends to use all sub-dimensions of processing strategies except memorizing and rehearsal. Conception of learning used only construction of knowledge. This means that learning is not considered as receiving raw knowledge provided by educational institutions through simply memorizing or doing simple tasks. Learning is also not considered as an attempt to seek knowledge to be put into practice. Learning is also not the task of teachers or books to stimulate student development. Learning is separated from excessive attachment to cooperation with other students. Students with active meaning-directed learning patterns consider learning as the development of knowledge and insights freely by and for themselves.

Figure 2. Active meaning-directed learning pattern

This active meaning-directed learning pattern is the only pattern that uses self-regulation strategies in learning. The learning process is managed personally through planning learning activities, monitoring progress, diagnosing problems, testing one's results, adjusting, and reflecting. This pattern also does not necessarily release external regulation strategies. Instead, external regulation is used to guide and support self-regulation.
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Academic Motivation

Based on the discussion related to learning patterns, it was found that self-regulation is influenced and accompanied by self-centered learning. Learning is not a process of accepting knowledge as it is from the outside but forming knowledge within oneself. This academic motivation factor explains the motivation behind the disposition of the learning pattern that uses self-regulation.

Students who have intrinsic motivation related to their field of study will feel the impact of a different learning environment from students who are less motivated (14). The same environment will have a better impact on those who are intrinsically motivated than those who are less motivated. The same environment will provide different achievements.

Academic motivation in this context is divided into three types, namely autonomous motivation, controlled motivation, and amotivation. Autonomous motivation is typified by freedom of choice and psychology (32). Controlled motivation does not contain freedom of choice and there is an experience of being forced or pressured (33). Amotivated students lack motivation to learn (32).

Autonomous motivation is positively related to the development of adequate regulatory learning outcomes (14). This type of motivation has similarities with students' conception of learning with an active meaning-directed learning pattern. There is freedom in learning. Learning is done not because it is determined by others but because of personal freedom.

Perceived Autonomy Support as A Factor that Mediates Autonomous Motivation and Self-Regulation

Fewer teachers are needed to facilitate students by increasing student self-activity and more support that triggers student autonomy. Based on a review of several studies, it was found that providing space for students to experience the freedom to make their own choices and to do so encourages the emergence of their autonomy motivation (14). Teacher's autonomy-supportive behaviour activates students to actively think, answer, collaborate, and reflect on learning. students' perceived autonomy support fosters self-regulation significantly (34).

The perceived autonomy support factor represents an explanation of the reason the type of institute of higher education has a relationship with self-regulation. It was explained earlier that the type of institute affects self-regulation because one of them is the quality of the teacher. How teachers can support student autonomy is an explanation of the relationship between type of institute and self-regulation. This factor is thought to be a factor that mediates the type of institute with self-regulation.

Student Conceptions of Feedback

The discussion on learning patterns shows that someone who uses self-regulation does not let go of external regulation strategies. The peculiarity of self-regulated students is how to respond to external regulation. The student conceptions of feedback factor discusses the way students view external regulation that can affect self-regulation.

According to Vygotsky's theory, students have a zone of proximal development. There are limits to student learning abilities (16). Beyond this limitation, there is a zone of ability that students can achieve with external support, one of which is through feedback from the teacher. Feedback is input in the form of information about aspects of a person's performance or understanding (35). Feedback has two forms, namely formative and summative depending on the time of delivery. Formative means that feedback is given at the beginning so that a task can be improved before it reaches the final stage. Summative means that feedback is given at the end of an assignment or study as an evaluation of the results, for example, the final grade.

Optimal use of the proximal zone through feedback will depend on student conceptions of feedback (36). Student conceptions of feedback factor predicted self-regulation. Various studies have shown that students who ignore assessments lead to maladaptive behaviours (37). On the other hand, students who find assessment useful for improvement exhibit adaptive self-regulation behaviour (eg, greater effort at work and greater achievement). while students who view the assessment as something that is ignored have a maladaptive response. It was found in another study that higher achieving students consciously on their own initiative used tutor feedback to facilitate self-regulation tasks while lower achievers used self-regulation less and relied on tutor feedback passively.

There are five forms of student conceptions of feedback (36). First, students actively use feedback which contains the subfactor enjoying feedback. Second, peer feedback is considered a significant help. Third, students ignore feedback. Fourth, feedback is considered to tell students if they are reaching or surpassing expectations. Finally, students consider that the input from the tutor/marker is helpful and clear.

Two of the five student conceptions of feedback had positive associations with self-regulation, namely 'active use feedback' and 'peers help'. There is a strong conceptual correlation between student conceptions of feedback active-use and self-regulation. Students who actively ask for and/or take advantage of feedback from anyone show the use of a self-regulated approach in learning. This also shows adaptive behaviour self-regulation to pursue achievement is to actively use external feedback. This is useful as a self-assessment and self-regulation guide for making improvements. In particular, the relationship between peer help and self-regulation suggests that feedback from classmates may be a useful check on how they are learning.

The Dynamics of Self-Regulatory Factors

Based on the discussion of each factor, the authors summarize the relationship in a chart as shown in figure 3. Academic year has a relationship with self-regulation, especially students who are undergoing a transition period, namely students at the beginning of the year and students who are nearing graduation. Circumstances that require adaptation and have challenges will urge students to use self-regulation. Age is a factor that mediates this negative relationship. The older the student, the smaller the self-regulation which may be due to increasing maturity, reducing tension in facing challenges.
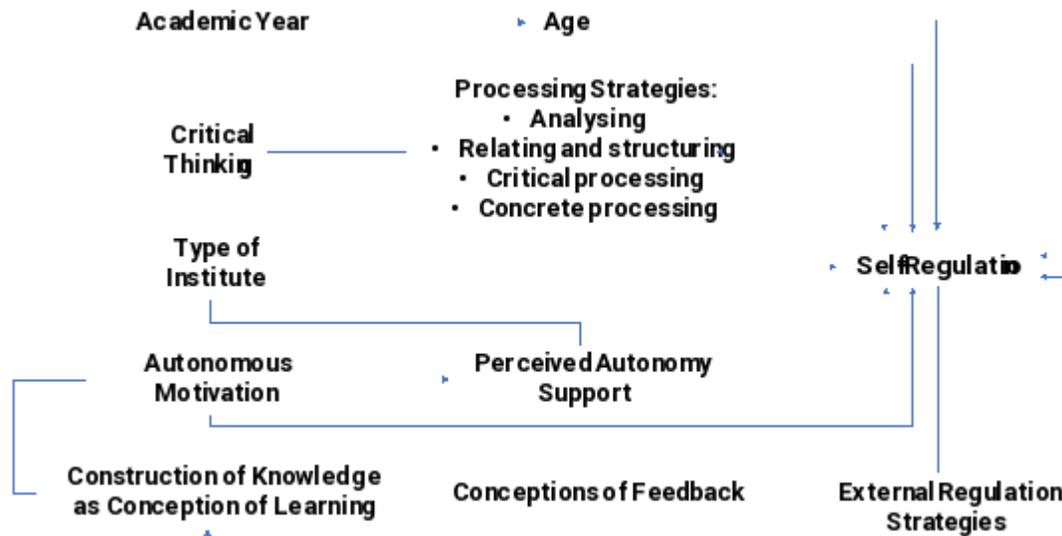

Figure 3. The dynamics of self-regulatory factors

Critical thinking has a positive relationship with self-regulation. In terms of ideas, critical thinking has similarities with the processing strategies of the learning pattern concept. Students who actively use self-regulation use most of the processing strategies which are part of critical thinking. Self-regulation and processing strategies influence each other according to learning pattern theory. This finding shows that many aspects of critical-thinking used by students predict the use of self-regulation.

The type of institution has a relationship with self-regulation. This relationship is explained by the differences in the quality of education from each higher education institute. The difference in quality is perhaps the idea of differences in perceived autonomy support. Students who get support for their learning autonomy will increase self-regulation so that perceived autonomy support mediates the relationship between the type of institution and self-regulation.

Autonomous motivation predicts student self-regulation. Perceived autonomy support mediates the relationship. This is because the more students are motivated as free learners, the easier it is for them to perceive positive support from teachers to support their autonomy. The higher the perceived autonomy support, the higher the self-regulation.

Autonomous motivation in the idea has similarities with the construction of knowledge as a learning conception. Autonomous motivation discusses freedom of learning while construction of knowledge is freedom in thinking. Learning as an autonomous choice and knowledge as an autonomous knowledge construction process. Construction of knowledge has a reciprocal relationship with self-regulation. This concept shows that self-regulation arises in individuals who are autonomous in motivation and way of thinking.

Student conceptions of feedback became the last predictor of self-regulation in this literature review. Students who actively use feedback from anyone tend to have higher levels of self-regulation. The same thing also happened to students who considered feedback from their fellow students as a meaningful help. The need for input and openness to peer input are good indicators of self-regulation. Students with high self-regulation need input from others to guide their development.

An explanation of the conception of feedback is also an explanation of external regulation strategies which are part of self-regulation. Students in self-regulation realize that they need external support that supports the achievement of their goals. Autonomy support and feedback including from external regulation. Perceived autonomy support and conception of feedback, on the other hand, exist at the level of student self-perception, so that the chart does not have a line connected to external regulation.

Based on the discussion of factors, self-regulation is influenced by factors that are interrelated with each other. This makes it easier to understand how to improve self-regulation of higher education students. The next question is how to improve self-regulation. In the following, some of the intervention methods used in studies on improving self-regulation will be reviewed. These methods are accompanied by a review using the self-regulation factors that have been discussed. The hope is that the application becomes more targeted and allows improvisation for anyone who tries to apply the method.

INTERVENTION FOR PROMOTING SELF-REGULATION

The method of increasing self-regulation, based on the studies reviewed by the author, can in principle be done by training or guiding it. Self-regulation can be trained by providing activities that hone the skills students need to regulate themselves. Students can also be guided to use self-regulatory skills during the study process using relevant prompts.

Life Narrative Reflection

The first intervention method discussed is a method that trains students' ability to do self-regulation. Based on the findings of (12), life narrative reflection in students is related to spontaneous self-regulation. Deep reflection helps students understand the limits of their own abilities in their respective areas of competence. Students then find ways to penetrate these boundaries and adapt them to social demands that are becoming a trend. The results of a review of several studies conducted by Klementyava and Ivanova found that reflection is a resource for intellectual, personal, and professional development because it is part of spontaneous self-regulation. Uncertainty situations that arise in the context of education require a large portion of reflective resources for self-regulation. Reflective abilities help students overcome anxiety and limitations when they realize they have to make choices and take responsibility for those choices.

Life narrative reflection or biographical reflection is a reflection of a life narrative consisting of life goals, autobiographical knowledge, biographical questions and answers, as well as formal structures. Biographical reflection becomes a personal resource for changing the existing settings of the everyday environment into patterns that can be personally adapted through self-regulation. Biographical reflection is an integral part of personality development contributing to growth and development relevant to professional competence in academic and professional activities. High-level biographical reflection can enhance self-regulation. Reflecting on the narrative of life as a source of self-regulation makes students more proactive and resolute when determining the path and evaluating their professional life.

Biographical reflection has two interconnected parts. First, reflection on other people's lives is a narrative reflection of life using external standards with a focus on objective descriptions using a socio-historical point of view on the opportunities and limitations that exist in the phases and milestones of life. Second, reflection on one's own life, which is a reflection on the narrative of life using internal standards, highlighting and picking lessons learned based on the phases and milestones of an individual's life. The two forms of biographical reflection relate to each other and establish psychosocial cohesion between the narrative of an individual's life and the concept of a culture-based biography (or culture-based life scenario), which includes a standard set of milestones that correlate with the predicted major developmental stages. The two forms of biographical reflection relate to each other into a combination of psychosocial reflection. Personal life narratives and culture-based life scenarios include a standard set of milestones that correlate with the predicted major developmental stages.

Reflection on one's own life contributes most significantly to an individual's self-regulation potential. Awareness of the authorship of one's life increases resilience and helps achieve important goals when faced with adversity. Self-regulation becomes wiser and has a broad perspective using adequate self-assessment of life in changing conditions facilitating overall self-reflection on the life path.

The effectiveness of biographical reflection, analysed based on the factors discussed earlier, shows the role of autonomous motivation from students. Reflection on one's own life that contributes more strongly becomes an illustration that motivation based on personal freedom has a big role in increasing self-regulation. The autonomy of learning becomes the main thing which is then supported by the role of external standards as a guide such as the

active meaning-directed learning pattern that uses self-regulation as well as external regulation. External standards are not positioned as a dictating factor because the main driver is student autonomy.

Considering the proportion between autonomy and external standards, students' conceptions need to be conditioned when applying biographical reflection. Personal learning by considering personal development from time to time becomes the main thing. Comparing oneself with the socio-cultural context should be conceptualised as a way to map one's development not as a way to judge oneself.

The critical thinking aspect is also a concern in the implementation of biographical reflection. The process of life reflection requires critical thinking so that the process of meaning becomes deeper. The hope is that the highest stage of Bloom's taxonomy is that evaluation in the context of life can be more optimal. This contributes positively to the increasing ability of self-regulation. Guidance in the form of questions that require critical thinking to answer is highly recommended.

Peer Feedback and Chatbot

The next intervention method is to train and guide the use of self-regulation. Chatbots are guiding and peer feedback is coaching and guiding self-regulation. Peer feedback and chatbot are two methods used in a study in the context of an academic essay writing exercise (38). This method contributes positively to the development of students' self-regulatory abilities, especially after this method was revised based on student input after a trial run was carried out in the study.

Peer Feedback

Peer feedback in the form of reviews of student essays by other students aims to promote students' ability to reflect, critical thinking, of course, to increase self-regulation capacity. Peer feedback plays a role in the development of independent learning, social skills, evaluative assessment, and self-management (39). At the same time, the process of compiling peer reviews develops students' independence, reduces dependence on teachers while increasing their evaluation skills (40).

Students were found to experience satisfaction with peer-reviewed assignments (38). This is because students are helped to activate self-reflection strategies on their own assignments and self-regulation strategies of their learning process. Students also become increasingly motivated to speed up their work and avoid academic delays.

The initial process of implementing peer-feedback raises students' reluctance to criticize their colleagues' assignments. Students are afraid to offend their colleagues and question their qualifications to provide input. Completion of the feedback application program was carried out using various inputs from students. Instructions that are used as a guide for students in providing reviews are made more detailed to develop skills in preparing feedback. Instructions are also structured so that students pay attention to the objectivity of feedback by providing a more detailed understanding of assignments and assessment criteria. The video explanation is made by the teacher as a guide and is accompanied by a written guide on making academic essays based on the expected criteria.

One of the inputs from students is related to motivation and involvement. The facility for implementing peer feedback is also enhanced by the use of a dashboard in the software program that guides the implementation of peer feedback. This dashboard provides a visualisation of the completion status of participants' tasks. This facility is intended to increase student motivation and engagement with visual aids. Emphasis on the usefulness of assignments for soft-skill development through peer-feedback activities was also frequently socialised by the teaching staff in response to this input. According to students, this can avoid inaccurate assessments. The quality of feedback becomes more controlled so that it is relevant for student development in the field of writing as well as in improving self-regulation.

Chatbot

The development and implementation of educational chatbots has the potential to support reciprocity through dialogue with students (38). The chatbot accommodates learning content and interactive feedback in the form of dialogue via chat with the program, as well as dialogue with fellow humans. Experts also found that interacting with chatbots generally increased student interest in learning (41). More than 50% of students stated that chatbots helped them in learning (38). Chatbots help students with abilities that are already being developed by themselves. The chatbot also guides students to be critical of the learning process that they run. Another benefit that is felt by students is that chatbots help them increase personal commitment and autonomy in the learning process.

Peer feedback and chatbots, based on the author's review, involve four factors of self-regulation, namely critical thinking, autonomy support, learning patterns, and student conceptions of feedback. Critical thinking is involved

with the process of compiling peer-feedback using cognitive processes to critique peer-reviewed essays. The application of feedback and chatbots is also support from the teacher so that students are increasingly able to learn autonomously. According to the learning pattern factor, feedback and chatbots are forms of external regulation that encourage processing strategies and serve as guides in the self-regulation process.

Research on peer feedback and chatbots has also paid attention to the student conception of feedback because it asks for input from students regarding program implementation and educates on the benefits of peer feedback for learning. Conception of the benefits of peer feedback can also significantly improve self-regulation. The advantage of this research is that researchers build a conception of peers feedback through socialization but also through socialization but also involves students to provide input. This method supports student autonomy by paying attention to their opinions to develop peer feedback as an external regulation. Peer feedback is a form of self-regulation because students participate in its development.

The chatbot from this research still needs to be developed again because almost 40% of sample students still do not think that chatbots are useful (38). It is better if the evaluation from students is not only aimed at the application of peer feedback but also chatbots. The goal is that more and more students will conceptualize chatbots as a meaningful help for increasing self-regulation.

Implementation and development of interventions

Biographical reflection, peer feedback, and chatbots pay attention to at least three things, namely autonomous motivation, conception of feedback or external regulation, and critical thinking. These three methods are proven to be effective in increasing self-regulation by taking these factors into account. Improving self-regulation can use these methods or can develop other methods as long as these three factors are considered.

The effectiveness of the method cannot be ascertained, especially since there are differences in the setting of the intervention with the background of the studies in this article. This article does not go into detail about the cultural background that contributed to the research and the detailed steps of each intervention. Guidelines for improving self-regulation need to be adapted from the big picture of the program to the details according to the local cultural context and relevant problems. Self-developed programs as well as the use of the methods presented in this article need to be evaluated using self-regulation measures for their effectiveness to ensure program quality in improving self-regulation skills.

Strengths and limitations

This article provided ideas that can be developed in the preparation of programs to improve self-regulation in students. This article is also an idea for further research. In the author's experience in sorting articles, the studies cited in this article are still rarely studied. Each study can be duplicated into various new studies thereby enriching data on self-regulation factors.

For limitation, this literature review has not reached the meta-analysis stage so it cannot be generalized. Each of the factors in this article is taken from studies in different countries. There are cultural differences that allow one factor studied in one country to have no relationship with self-regulation when examined in another country. This needs to be tested in further studies.

CONCLUSIONS

Self-regulation is influenced by several factors, namely academic year, age, type of institute of higher education, critical thinking, autonomous academic motivation with perceived autonomy support as mediating factor, and student conception of actively using feedback and perceived helpful peer feedback. Active meaning directed pattern also shows the use of self-regulation which has a reciprocal effect with processing strategies (except memorising and rehearsal), external regulation strategies, and construction of knowledge as conception of learning.

Interventions that can improve self-regulation are life narrative reflection, peer feedback and chatbots. In the application of these three factors, there are at least three factors involved, namely autonomous motivation, conception of feedback or external regulation, and critical thinking. The development of self-regulation can use these interventions or can develop their own programs as long as they pay attention to these three factors and evaluate the improvement of self-regulation using valid and reliable instruments.

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