Investigating the Relationship between School factors and Self-Regulated Science Teaching in Secondary schools of South Gondar Zone, Ethiopia

Mekuriaw Mengistnew Teshome & Amare Sahile & Dawit Asrat

http://dx.doi.org/10.29009/ijres.5.2.9

Investigating the Relationship between School factors and Self-Regulated Science Teaching in Secondary schools of South Gondar Zone, Ethiopia

Mekuriaw Mengistnew Teshome
Department of psychology, University of Gondar, Gondar, Ethiopia
mekurish2009@gmail.com

Amare Sahile
Department of Psychology, Bahir Dar University, Bahir Dar, Ethiopia
amareabebe97@gmail.com

Dawit Asrat
Department of Psychology, Bahir Dar University, Bahir Dar, Ethiopia
dawit.asrat.getahun@gmail.com

Received October 19th, 2021, **Accepted February 20th 2022**

Abstract: The purpose of this study was to investigate the relationship between school factors (STRA, &PLC) with teachers' self-regulated science teaching in secondary schools. Self-report questionnaires for PLC and SR were adapted and for STRA it was developed by the researcher. To make the instruments' valid and reliable, it was checked by experts and pilot study was conducted. Nine (14.3%) secondary schools out of a total of 63 secondary schools found in South Gondar Zone of the Amhara Region, Ethiopia were selected randomly. After selecting the schools, all science teachers, 322 (chemistry, biology and physics) in the selected schools were taken as participants using comprehensive sampling techniques.302/322=93.8% (of which 71(23.5%) were females, 231(76.5%) were males; 32.5% chemistry;34.4% physics and 33.1% biology teachers successfully responded to the three questionnaires. Pearson correlation coefficient, multiple regression analysis and structural equation modeling analysis methods were employed. The result showed that the model was adequately fit to the data; PLC only was found a significant positive correlation,

http://dx.doi.org/10.29009/ijres.5.2.9

predictor and effect with teachers' self-regulated science teaching. Whereas STRA showed low correlation and non-significant predictor and has no significant effect on teacher's self-regulation. Implications and recommendations are indicated

Key words: teachers' self-regulation; professional learning community; science teaching resources; Self-regulated teaching

http://dx.doi.org/10.29009/ijres.5.2.9

Using Self-regulation and strategic action in educational settings have been found effective in maximizing students' learning and achievement. It is mainly investigated with students' learning and achievement though it is expected to contribute for the improvement of teachers' teaching effectiveness. So, there is growing interest on investigating the impact of the construct(self-regulation) on teachers' teaching effectiveness and its relationship with some teachers' personal characteristics currently. For example, Capa-Aydin, Sungur, and Uzuntiryaki (2009): Arrastia (2015);Gol and Royaei, (2013);Ghonsooly and Ghanizadeh (2011); Toussi, Boori, and Ghanizadeh (2011) conducted a study on teachers' self-regulated teaching. Teachers' teaching quality is the one and important influential issue among the contributing factors for students' learning and achievement. Hence if teachers are self-regulated, it is believed that they would be responsible for their teaching task, for their students' learning, self-determination, committed and positive towards helping their students. According to Bembenutty,White, and Velez(2018), self-regulation comprised of an essential components that make individuals effective in their task with self-control of individuals over their situations, environments, and contexts. And Self-regulatory strategies are tactics and techniques used to accomplish specific task including setting goals, task analysis in planning, carefully choosing appropriate strategies when approaching a task, generating self-instructions on how to complete the task, managing resources effectively, creating effective environmental settings, monitoring progress, evaluating one's own performance, seeking help from appropriate sources when needed, and providing rewards or imposing consequences based upon performance out comes (Zimmerman, 1998).

Hence, individuals in self-regulation are not subjected to stimulus control as just like behaviorists; rather they exercise cognitive, emotional, and

http://dx.doi.org/10.29009/ijres.5.2.9

behavioral power over their surroundings (personal agency). It is their intrinsic motivation that gears the behavior towards accomplishment but not external reward that triggers to achieve their goals. So, self-regulation refers to self-generated knowledge, thoughts, feelings, and actions that individuals use to help themselves attain their desired goals (Zimmerman, 2002).Self-regulators are self-directed, intrinsically motivated and take full responsibility for their task and always search better ways for improvement. In line with this, many researchers' study findings indicate that self-regulators are those who strategically apply cognitive, metacognitive, resources, and task-specific strategies as well as set achievable goals, plan, self-monitor, reflect, and adapt their approach and tend to out-perform others (Callan, 2014).

Zimmerman (2000) has developed three cyclical phases of self-regulated learning by which each phase is affected by one another. The phases are Preparatory phase or forethought phase, performance or volitional phase and self-reflection (self-reaction) phase.

So, using the analogy of self-regulated learning and its effectiveness in students' learning and achievement, researchers tried to apply it to teachers' instructional practice(for example teachers' self-regulation as learners conducted by Bembenutty(2006); Corrigan andTaylor (2004); and with in-service teachers self-regulation by Toussi, Boori, and Ghanizadeh(2011); Capa-Aydin et al.(2009); Lombaerts and Engles(2009); Peeters, Backer, Reina, Kindekens,Buffel,and Lombaerts (2014); and Arrastia(2015). Because, teacher's self-regulation is found an important skill in maximizing students' learning and achievement. This is due to that teaching using self-regulated strategy is necessary for teachers in order to deal with the complexity of the teaching role, which requires to take care of different factors. As self-regulation helps students to take responsibility in their own learning, it can be expected

http://dx.doi.org/10.29009/ijres.5.2.9

also to assist teachers in their own professional development. From the personal and individual perspective, teachers need self-regulation to consider themselves as a teacher and keep up their motivation. In their profession, they need to cope with diverse population of students, perform different tasks, goals and in this ever changing complex scenario, they have to constantly nurture their motivation, sense of purpose, commitment, satisfaction and effectiveness; to understand their students' needs, to initiate their way of thinking and their creativity, and to match with the variety of situations and conditions they face in the classroom and adjust to the dynamic curricular revisions (Delfino, Dettori, & Persico, 2010).

However, teacher's self-regulation can be affected by teachers' external and internal characteristics. The ineffectiveness of instructional strategies specifically self-regulated teaching can be attributed to the inefficiency of either the personal factors (affect, and cognitive), or the socio-environmental factors (lack of models, or support) and or lack of supportive and enabling environments. Generally cognitive, affective, motivational and socio-environmental challenges produce a range of self-regulatory dysfunctions. On the other hand, teachers may lack self-regulatory skills due to that they may not have a pre-service training in their teacher education, their school culture also may not support to develop this skill and or they may lack positive attitude towards their profession so that they may not be interested to search and apply new innovative strategies.

Although, there are many characteristics external and internal to teachers that affect teachers' self-regulated teaching positively or negatively, this study was aimed to investigate the relationships between teachers' professional learning community practice in the school for teaching with self-regulation, the relationship of science teaching resource availability with teachers' self-

http://dx.doi.org/10.29009/ijres.5.2.9

regulation. Because there is no research conducted on these three school and personal factors in one study so far as far as the researcher's search is concerned. Besides this, different study results showed that professional learning community practice (planned and continuous professional dialogue among teachers) and sufficient teaching-learning resources can enhance teachers' teaching confidence in using new instructional strategies. And it was assumed that it would contribute for the improvement of teachers' instructional skill by investigating how much self-regulated teaching can be affected or what nature of relationship it has with the teaching resource availability and professional learning community practice so that remedial measures would be taken by responsible bodies.

Professional Learning Community Practice for Teachers' Self-Regulation

Though it needs the willingness and interest of all staff to participate and share their experiences, school principals are an important figure that can play a great role in facilitating and arranging conducive environment for teachers' professional development. Involving in reflective dialogue is an important characteristic of professional learning communities (PLC's). PLC refers to the communication and discussions among teachers about important educational issues (De Smul, Heirweg, Devos, & Keer, 2018).

Many researchers give definition for professional learning communities whenever there is collaboration, cooperation, sharing experience and knowledge among staff members. For example, Blitz and Schulman, (2016) defined PLC as teams of educators (most commonly teachers) who meet regularly (often but not always during scheduled school time) to develop lesson plans, examine student work, monitor student progress, assess the effectiveness of instruction, and identify their professional learning needs. On the same

http://dx.doi.org/10.29009/ijres.5.2.9

manner Hipp and Huffman (2010) explain learning community as "professional educators working collectively and purposefully to create and sustain a culture of learning for all students and adults." (p. 12); similarly, Mitchell and Sackney(2000) explain a learning community as a community in which teachers reflect and learn collaboratively so that they may respond to the “mysteries, problems, and perplexities of teaching and learning” (p.5), and for continuous improvement by building staff capacity for learning and change (Hord, 1997). Indeed, for teachers, learning to be self-regulated is an essential from both individual and social points of view (Moafian & Ostovar, 2012); also identified professional learning community as (1) reflective dialogue, (2) focus on student learning, (3) interaction among teacher colleagues, (4) collaboration, and (5) shared values and norms.

Professional learning community practice has an immense contribution for the development of teachers’ teaching self-efficacy by then implementing self-regulated teaching.

The continuous professional development is an in-school program by which teachers share and learn with each other how to improve their teaching skill and students’ learning especially a senior and experienced teacher as a mentor. This type of school culture contributes to enhance teachers teaching efficacy belief to be committed and encouraged to apply innovative instructional strategies like self-regulation. Though the program was designed and installed in the school system as continuous professional development(CPD) in Ethiopia, however, the program was not effective and teachers were not intrinsically motivated and was not long lasting as to my experience, In addition to this Fekede (2015) in his case study identified that there is a problem of implementation and lack of leadership skills to design, coordinate and evaluate the program.

http://dx.doi.org/10.29009/ijres.5.2.9

Another study was conducted by Arslan, (2017) to investigate the predictability of self-efficacy to collective efficacy in preschool teachers of Turkey. The correlation and regression analysis showed that self-efficacy has a positive correlation with collective efficacy and 50% of its variance is contributed by self-efficacy. It can be considered that teachers with high level of professional perceptions are also successful in collective self-efficacy levels. Teachers with a low perception of their profession may avoid working with others; they may also think that they are inadequate or unsuccessful. Organizations' innovative climate has positive impacts on teaching behaviors Chou, Shen, Hsiao, and Shen (2019, cited in Ching Mok & Moore, 2019). Teachers' perceptions about their professions, and collective self-efficacy levels can also be affected by Work environments. An individual may be reluctant to work with other individuals in an environment where his/her professional knowledge is not referred, is not supported or appreciated, and his opinions and recommendations are not taken into account. In the school environment, it causes feelings of discouragement, insensitivity and insecurity to develop (Goddad & Woolfolk-Hoy, 2000 as cited in Arslan ,2017); there will be lower self-efficacy judgement of the teacher him/herself to practice innovative instructional strategies According to the study of Thoonen et al. (2011), as cited in Börü, (2018), the school level of security, trustworthiness, incentive, and the level of cooperation and collaboration among staff motivates teachers to improve their teaching activities. Tschannen-moran and Mcmaster (2009) identified that professional development format that supported mastery experiences through follow-up coaching had the strongest effect on self-efficacy beliefs for reading instruction as well as for implementation of the new strategy. Butler(2003)also identified that teachers came to make shifts in practice through participating in collaborative learning and research with teams

http://dx.doi.org/10.29009/ijres.5.2.9

of fellow teachers and researchers. Whereas Nolan, (2009) identified a negative correlation between school professional learning community and teachers' efficacy which is un usual. And Sweigart (2012) examined the difference in self-efficacy of teachers who participated in PLC and those who did not to enhance use of innovative instructional strategies. The result of the study reveals that there is no difference among those groups. So, the current study investigated how much the professional learning community practice contributes to teachers' self-regulated science teaching.

Science Teaching Resource Availability for Self-Regulated Teaching

Adequate and appropriate school resources can be used as an input to enhance quality teaching-learning process. The quality of science teaching and learning experience depends on the extent of the adequacy of laboratory facilities in secondary schools and the teacher's effectiveness in the use of laboratory facilities with the aim of facilitating and providing meaningful learning experiences in the learners (Pareek, n.d.).The researcher noted that "I would argue that any course in science does not show its excellence until it is related to practical work'' (P.76). Similarly, it is explained that science teaching at the present time does not appear to promote the development of 21st scientific literacy. Teaching science is enabling students to discover, investigate, prove or disprove theoretical thoughts, solve problems, innovate new ideas based on their environment, and the school. In addition to this, Flick and Lederman(2006) identified abilities that enable students to conduct scientific inquiry through scientific investigation can design and conduct a scientific investigation, use appropriate tools and techniques to gather, analyze, and interpret data; develop descriptions, explanations, predictions, and models using evidences; think critically and logically to make the relationships between evidence and explanation; recognize and analyze alternative explanations and predictions and communicate scientific procedure and explanations. Ajileye (2006)

http://dx.doi.org/10.29009/ijres.5.2.9

cited in Lekhu (2013) contend that insufficient resources for the teaching and learning of science constitute a major cause of student underachievement. Teachers in resource-poor settings may feel that the context constrains their use of instructional strategies. Science teaching resources refers to the human and non-human resources used for the purpose of science teaching; like laboratory technician, laboratory chemicals, equipment, furniture, source of power, water, buildings, etc.

A study conducted by Achimugu(2016) to investigate factors affecting effective implementation of the senior secondary education chemistry curriculum in Kogi State, Nigeria shows that poor motivation of teachers, insufficient funding, lack of adequate time to cover the curriculum, inadequate laboratory and voluminous nature of chemistry curriculum were among the factors for poor implementation of the curriculum. Similarly Habtamu (2017);Oli (2014); Ashebir and Bereket(2019) conducted a survey research in North Gondar, in Oromia, Amhara and South Nation and Nationalities of Ethiopia secondary schools respectively to assess quality of science education; and their independent study results show that insufficient teaching and learning resources, lack of well-equipped laboratories, [poor] students' attitude towards science, non-conducive classroom environment, insufficient time for teaching science and large class sizes, lack of commitment and interest of teachers, as factors affecting teaching science subjects. This reason works for the finding of the National Learning Assessment report (MoE,2013) conducted for grade 10 and 12 Biology, Chemistry and Physics from 2000-2010 E.C show (Bio,40.3&55.5; Chem,36.1&49.1; Phy,31.2&36.6) respectively which is all below average (50%). Limited equipment, access to a suitable science teaching space, lack of support staff to assist with organized and storing materials, an inadequate science budget, poor access to laboratories, and inadequate

http://dx.doi.org/10.29009/ijres.5.2.9

equipment are the common limiting factors indicted by teachers (Rennie, Goodrum, & Hackling, 2001). Similarly, a study conducted by Aktam and Acar (2010) in Turkey shows that “Laboratory Practices in Science Teaching” course’s effect on development of self-regulation skills during elementary science teaching. To show the importance of science teaching resources, the findings of the study conducted by Martin (2017) in Cameroon secondary schools shows that there is a significant relationship between the availability of resources and the efficiency of the school system. This indicates that if schools are deprived of teaching resources, teachers will not be motivated to teach their students and may lose their confidence to conduct with innovative instructional strategy. Actually, professionally committed and dedicated teachers can be seen creating models for their teaching and are effective. Similarly Andersen, Dragsted, Evans.and Sørensen(2004) found that positive changes in self-efficacy seemed positively related to the occurrence of environmental factors helpful to teaching. In addition to this an exploratory study conducted by Corrigan and Taylor (2004) indicted that the self-regulatory environment increases their understanding of activity-based teaching-learning and their teaching confidence.

Objectives of the Study

The objectives of this study were

1. To investigate whether there is a significant relationship between professional learning community practice with self-regulated science teaching?
2. To examine the relationship between science teaching resource availability with self-regulated science teaching.
3. To test how the hypothesized model supports the data.

http://dx.doi.org/10.29009/ijres.5.2.9

Methods

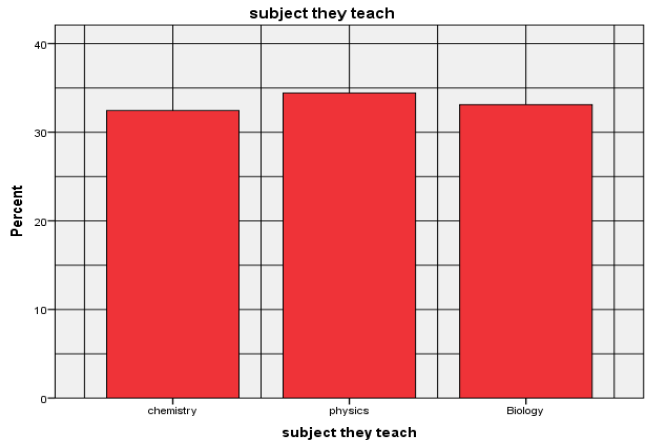
This study followed quantitative survey design by collecting self-report data from the selected secondary school science teachers of the study area.

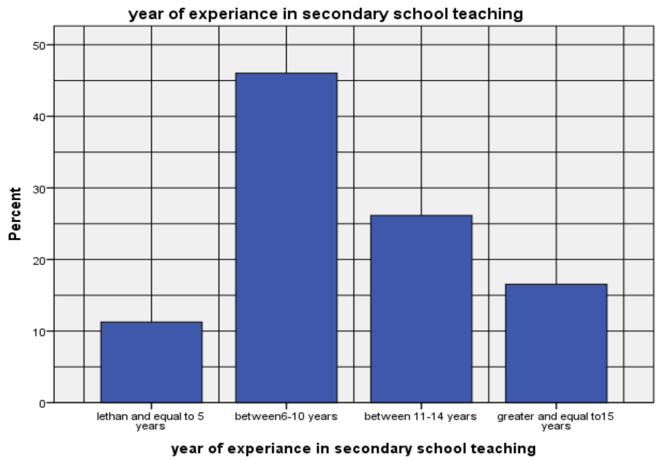
Participants

The participants of this study were science teachers (chemistry, physics, and biology) found in the study area of south Gondar administrative zone of the Amhara region, Ethiopia. The total number of secondary schools were 63 with 1186 teachers and from these, nine secondary schools (14.3%) of the total population were selected using simple random sampling method. And all teachers (322) from those randomly selected schools were taken using comprehensive method. Only 302/322 respond correctly. From the participant teachers (98=32.5% were chemistry, 100(33.1%) were Biology and 104(34.4%) were Physics); and among these, 71(23.5%) were females and 231(76.5%) were males; Of the 302 teachers,74.5% were first degree holders and the other 25.5% were masters. Teachers were categorized in to 4 groups based on their teaching experience career structure (teachers from 0 to 5 teaching year experience are called 'beginners and junior teachers') and were made to be in one category; from 6-10 teaching experience are called 'Teacher and senior teachers') were made another category; from 11–14-years teaching experience are called associate lead teachers were made to be another category; and the fourth category are those who have 15 years and above teaching experience called 'Lead teachers'. Hence, majority of the participants (46%) have 6-10 years teaching experience,26.2% have 11-14 years of experience; 16.5% of them 15 years and above; and 11.3% below 5 years of experience in secondary school science teaching were participated in the study.

http://dx.doi.org/10.29009/ijres.5.2.9

Figure 1: Participants' Back Ground Variables (by experience, subject, and gender from left to write)





http://dx.doi.org/10.29009/ijres.5.2.9

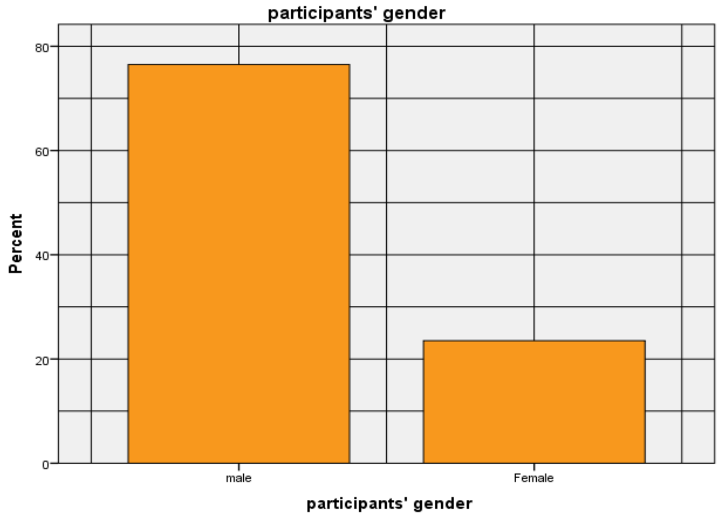


Figure 1 Participants' Back Ground Variables (by experience, subject, and gender from left to write)

Instruments

The study was conducted to investigate the relationship between professional learning community practice for self-regulation, the availability of science teaching resources for self-regulated science teaching. A self-report questionnaire for professional learning community practice for self-regulation containing 35 items were adapted from Olivier, Hipp, and Huffman (2010) as available in Heaton, (2013) ; and for science teaching resource availability for teaching efficacy belief containing 22 items were developed by the researcher; and the self-regulated science teaching instrument containing 40 items was developed by Capa-Aydine et al. (2009) and adapted for this study. The validity of the instruments was evaluated by experts from different discipline (eg. From education faculty, and from psychology department) in addition to this, it was evaluated by the researcher advisors for its, purposefulness, and adequacy and amendments were made. Moreover, pilot test was conducted with the four

http://dx.doi.org/10.29009/ijres.5.2.9

instruments and the total items' reliability was found to be in the acceptable range (for PLC with Cronbach alpha= .93; for SRTS=.94; and for (science teaching resource availability, STRA=.89). However, when the subscales' reliability was checked, self-instruction from STSR=.57; Supportive conditions and structure subscales of PLC =Alpha .46; chemicals and apparatus sub scale of STRA=Alpha of .32 were detected. Hence, based on these lower reliability result and respondents' feedback, some items were corrected and reduced. So, the total number of items used for the main study were made to be PLC=35; STRA=22; and for SRST=37.

Data Analysis Procedure and Methods

Teachers' self-report data were collected from 322 science teachers working in the nine secondary schools. 302 questionnaires were found completely responded by the participants when checked in the preliminary data screening process. Assumptions' tests were conducted for all the variables (for independent and dependent); missing values were substituted using multiple imputations (serious mean method) and outliers were corrected to the nearest larger value for the sake of saving data from reduction. In addition to this, both univariate and multivariate normality, multicollinearity, linearity, homoscedasticity was checked before analysis.

Principal component analysis with Varimax rotation was used to explore the component structure of the attitudes towards the implementations of self-regulated teaching. Values of KMO(.78) and Bartlet's of test(Chi-square=1253.79; df=210;p<.001) permitted further analysis. Hence, the two tests as indicated above explain the adequacy of the samples for factorability to maximize interpretability and the solution, (the pattern of loadings). The

http://dx.doi.org/10.29009/ijres.5.2.9

Varimax rotation method was done because of its simplicity and interpretability; and is found to be preferable (Pallant, 2001).

Table 1 Rotated component Matrix for SR here

Rotated Component Matrix of SR data							
	Component						
	1	2	3	4	5	6	7
Goal3						.813	
Goal5						.769	
HS1			.797				
HS2			.696				
II1					.737		
II3					.728		
MGO1		.714					
MGO2		.692					
MGO3		.698					
MGO4		.752					
PGO2	.740						
PGO3	.704						
PGO4	.735						
PGO5	.758						
SE3				.749			
SE4				.625			
SI2				.423			
SI4				.715			
SR3							.796
SR4							.500
HS3			.608		.368		

Eigen.value=	4.3	2.1	1.5	1.49	1.4	1.2	1.0
Variance in% =	11.64	11.43	8.85	8.31	7.13	6.52	5.11
Cronbcah α =	.76	.75	.62	.63	.55	.49	

http://dx.doi.org/10.29009/ijres.5.2.9

The principal component analysis with iterated varimax rotation resulted teachers' self-reported opinion regressed to a total of seven Components or Factors with an Eigen value >1 and 59.00% of the total variance accounted for by the components) are retained. In the commonality's matrices, the self-reaction item number 3 (I get upset, when I am negatively evaluated in my profession) shares the highest variance proportion (.700) or is accounted for by the component. Whereas from self-instruction item number 2(If the strategies I have used in my science teaching do not work, I utilized alternative strategies) accounted for by the component the lowest variance proportion in commonality (.30).

The reliability of the items by their factor grouping was found very poor to good (Cronbach alpha α =.05 to .76; Factor one called Performance goal orientation α =.76; Factor two, or Mastery goal orientation α=.75; factor three or Help seeking α=.62; Factor four or Self-evaluation α =.63(containing two items from self-instruction); Factor five or intrinsic interest, α=.55; Factor six or goal setting, α=.49; Factor seven or Self-reaction α =.05) with the lowest reliability value. The confidence level for statistical significance was determined to be 95% at alpha value p< =.05. The rotated component matrix indicated that the highest variance is explained by factor one or component 1(11.64%) which contains four performance goal orientation items and the lowest variance is explained by factor or component 7 (5.11%) which contains only two items of self-reaction. Items that have commonalities are regressed to be in the same factor.

The numbers of factors extracted as indicated above are 7 which are different from the study result of Arrastia (2014); that of Moafian and Ostovar (2012) and Capa-Aydine et al. (2009) who extracted 9 factors. This may be due

http://dx.doi.org/10.29009/ijres.5.2.9

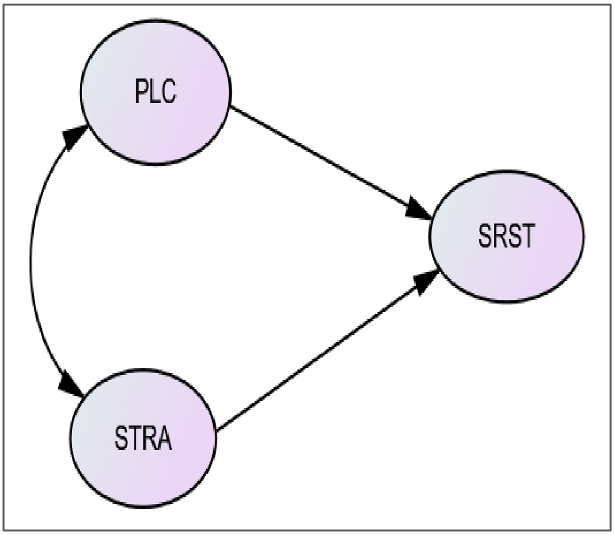
to the reduction of 3 items for this study and or may be due to context differences.

Similarly, a principal component factor analysis with varimax rotation was conducted on science teaching resource availability data. An initial analysis reveals with measure of Sampling Adequacy and Bartlett's test of sphericity (KMO=.89, Bartlett's test of sphericity=2273.758, df=231; Sig=.000) indicating its sampling adequacy for factorability. With iterated varimax rotation method 3 factors with eigen value greater than1 were retained. Factor 1 called 'Infra structure' which contains 8 items with a variance of 29.7 % and a reliability of Cronbach α=.85; Factor 2 called 'Reference and texts' containing 3 items with a variance of 15.2% and reliability of Cronbach α=.68; Factor 3 called 'Chemicals and equipment containing two items with a variance of 12.4% accounted for by the factor and reliability of Cronbach α=.66 were retained.

The same principal component analysis with varimax rotation was conducted on professional learning community data. The Kaiser-Meyer-Olkin measure of Sampling Adequacy and Bartlett's test of sphericity showed its factorability (KMO=.94, Bartlett's approx.=4989.909, df=595, Sig. value=.000). Hence, 5 factors with total variance of 43.5% was retained. The factors are; factor 1 called shared values and vision containing 5 items with reliability of Cronbach α=.83; factor 2 called collaborative learning and application containing 4 items with α=.75; factor 3 called supportive conditions and structure containing 3 items with α=.81; Factor 4 called 'supportive and shared leadership' containing 4 items with α=.67; Factor 5 called supportive condition and relationship containing 3 items with α=.66 was retained.

http://dx.doi.org/10.29009/ijres.5.2.9

Figure 2 Hypothesized Theoretical Model



From the above diagram, it represents that the professional learning community practice (PLC) and science teaching resource availability (STRA) has a relationship with teachers' self-regulation. Theoretically its meaning is that the level of dialogue and experience share under taken in the school among teachers enhances the teaching efficacy belief of teachers so that they can be innovative, creative and willing to implement new instructional strategies. In addition to this the presence of sufficient teaching resources (human and material resources) are assumed to increase teachers' teaching efficacy for effective teaching by using different innovative teaching approach. Particularly science teaching should be supported with practical and inquiry-based teaching.

So, the type of analysis used to test the nature of relationship among the indicted variables and the covariance created is structural equation modeling AMOS version 23 and Pearson correlation coefficient, multiple regression without covariance. The structural equation model analysis process passed

http://dx.doi.org/10.29009/ijres.5.2.9

procedurally model specification, model identification, model estimation, and model evaluation and model modification

Results and Interpretation

Correlational Analysis Result

Before conducting multiple regression, the Pearson correlation coefficient of the dependent and independent variables were checked independently and together. Hence the result showed that science teaching resource availability (STRA) with Self-regulated science teaching (SRST) is r=.28 which is a week relationship, and that of PLC (professional learning community practice) with SRST is r=.47 which is relatively moderate relationship and that of STRA and PLC is r=.41 which is moderate. These correlation coefficients indicate there is no multicollinearity among the variables. That is why multiple regression and structural equation model analysis were conducted.

Multiple Regression Analysis Result

To test the relationship that have between professional learning community, science teaching resource availability with self-regulated science teaching, a standardized multiple regression analysis was conducted.

From the model summary table, the multiple correlation coefficient value which represents the quality of measure of the prediction of the DV is R= .479, and the proportion of variance in the DV that is explained by the independent variables or R-square is=.229 (22.9%). In addition to this from the ANOVA table showed the regression equation that the model as a whole is statistically significantly predicted the DV,

http://dx.doi.org/10.29009/ijres.5.2.9

F (2, 299) = 44.466, p < .05, R2 = .229; indicating the regression model is a good model fit of the data. However, when the two variables are included in the model and evaluated individually as indicated from the table below.

Table 2 Standard Multiple Regression Coefficients here

		B	Std. Error	Beta	t	Sig.
1	(Constant)	101.262	4.871		20.789	.000
	PLC	0.557	0.073	0.425	7.656	.000
	STRA	0.763	0.394	0.107	1.934	0.054

*****P<.05**

Professional learning community variable was the only significant predictor of SRST (b=.557, Beta=.425, t(300)=7.66, p<.05 by making STRA variable constant. 42.5% of the variance in the DV is accounted for by PLC independent variable. Whereas the STRA was not found a significant predictor of the DV, (SRST), t (300) = 1.934, p=.054

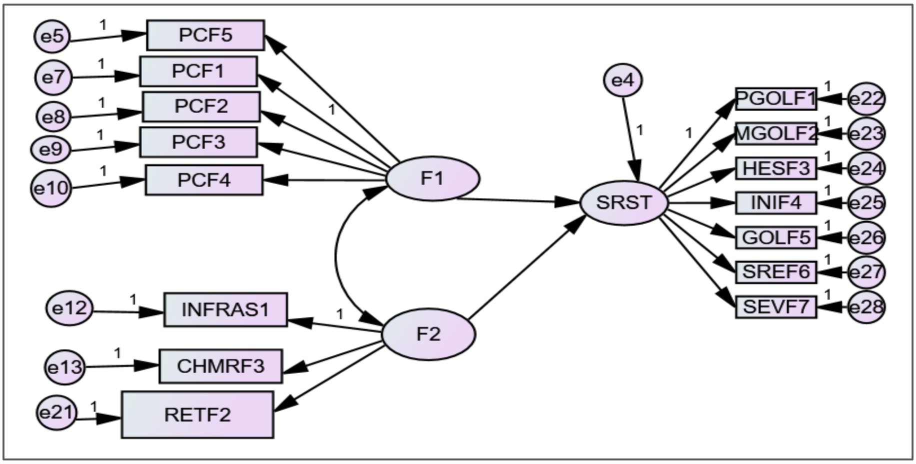
SEM Analysis Result

A/ Model specification

This step involves using theory and previous research to justify variable relations in a hypothesized theoretical path model. Model specification is a first step in confirmatory factor analysis, just as it was for multiple regression and path models. Model specification is necessary because many different relations amongst a set of variables can be postulated with many different parameters being estimated (Schumacker & Lomax,2016). The specification is based on the hypothesized model driven from theory. The following diagram represents the specification of the hypothesized model

http://dx.doi.org/10.29009/ijres.5.2.9

Figure 3 Specified SEM Model here



From the above diagram, F1/PLC and F2/STRA are exogeneous or independent or unobserved variables, whereas SRST is an endogenous variable. For PLC exogenous variable there are 5 factors containing composite items serve as indicators or observed variables with 5 error terms; and the science teaching resource availability (STRA/F2) construct has 3 composite indicators or observed variables and 3 error terms; The dependent or endogenous variable (SRTS) contains 7 indicators, 7 error terms and one residual error. The indicators or observed variable of the latent factors are composite factors containing different number of items. For example, In PLC latent variable PCF1 is composed of 5 items, PCF2 is composed of 4 items, PCF3, PCF4 AND PCF5 are each composed of 3 items. With a reliability of Cronbach alpha of greater than .66 And the science teaching resource availability construct is assumed to be explained by the four composite factors with 4 error variances; INFRAS1(infrastructure factor one) is composed of 8 items, CHMRF3(chemicals and equipment factor three) is composed of 3 items, RETF2(References and texts factor two) composed of 2 items. The dependent

http://dx.doi.org/10.29009/ijres.5.2.9

variable (SRTS) has 7 factors from which factor one (PGOLF1) composed of 4 items, whereas the last or the 7th factor is composed of only two items and the other five factors are composed of 3 items each and their reliability coefficient ranges from an alpha of .51 to .76.

From the hypothesized model, there are arrows that show direct effect and one non- defined correlation/ relationship. The PLC and STRA latent variables were hypothesized to have a direct effect on self-regulated science teaching (SRTS). There is also covariance between the exogeneous variables (PLC & STRA) connected by a bi-directional headed arrow.

B/ Model Identification

To assess whether the proposed model is fit or not, the first thing to do in this stage is identifying the number of distinct values, the number of parameters to be estimated and the degree of freedom. And we have to confirm that the number of free parameters to be estimated must be less than or equal to the number of distinct values in the matrix of S(sample). Hence, from the specified model there are; 15 indicators or observed variables, 15 error terms,2 path loadings and 1 covariance among two latent variables. Generally, there are 33 parameters to be estimated; the number of distinct values can be calculated by p(p+1)/2, where p= the number of observed variables in the model. Therefore, p=15; 15(15+1)/2= 120; hence, the number of distinct sample movements S (120) is greater than the number of free parameters ,33. The degree of freedom, DF = 120-33=87 degrees of freedom. This model is over-identified because there are more values in S than parameters to be estimated, that is, the degrees of freedom in this model is positive and not zero (just-identified) or negative (under-identified).

http://dx.doi.org/10.29009/ijres.5.2.9

C/ Model Estimation

The next step after identification is estimating the parameters using the default maximum likelihood method available to researchers using AMOS program (Meyers, Gamst, & Guarino, 2006). Based on the results of the estimation, the proposed variance-covariance metric is compared. against with the actual or the population metrics using Chi-square value, degrees of freedom and the p-value. According to Schumacker and Lomax (2016), a non-significance chi-square statistic is indicating the model is tested for fit, and other subjective indices. When chi-square is non-significant it indicates that the original variance–covariance matrix and the model-implied variance–covariance matrix is similar. This implies that the model is a good representation of the relations amongst the observed variables. We tested our theoretical model by means of SEM. In order to assess the model, fit, we used several fit indices: the $\chi 2$ test, the comparative fit index (CFI), the Tucker–Lewis's index (LI), the standardized root mean residual (SRMR), and the root mean square error of approximation (RMSEA). When the $\chi 2$ test is non-significant ($p > .05$) the model fit is good (Hu & Bentler 1999) as indicated in Schumacher and Lomax (2016). However, the $\chi 2$ test is a sensitive test and usually significant when having a large sample size. Therefore, we also checked the $\chi 2/df$ ratio, which should be as small as possible: ≤ 2 indicates a good fit; ≤ 3 an acceptable fit(Schermelleh-Engel, Moosbrugger, & Müller, 2003). For the CFI and the TLI, we consider a critical value of .90 a reasonable fit, while a fit larger than .95 is good. As for the SRMR and the RMSEA, a fit between .06 and .08 is reasonable and a fit below .06 is good (Hu and Bentler 1999). The results show a good fit based on the following fit indices by modification indices: $\chi 2 = 139.909$, $df = 84$, $\chi 2/df = 2.203$, $p =.000$, SRMR = .240, RMSEA

http://dx.doi.org/10.29009/ijres.5.2.9

= .046 with PCLOTH .68; and an adequate fit based on the CFI and TLI: CFI = .94, TLI =.93.

The parameter estimates results of SEM showed that the presence of professional learning community practice in the school or continuous and planed dialogue among teachers about their effective teaching can create a confidence on them to be self-regulated. It is evidenced in the model which showed that PLC has a significant effect on teachers' self-regulated teaching (Regression unstandardized weight=.378 and standardized estimate=.55) this implies that when PLC Goes up by 1 standard deviation, SRST increases by .55 standard deviation; whereas the presence of science teaching resources in the school as they reported did not show significant effect on teachers' self-regulated teaching. From the result it is also observed that there was a significant non directional covariance formed between school factors (PLC &STR).

Table 3 Standardized (Std.E) and Unstandardized Etimates (Unstd.E) of SEM here

		Unstd.E.	Std. E	S.E.	C.R.	P
SRST	<---F1	0.378	0.55	0.091	4.168	***
SRST	<---F2	0.485	0.147	0.447	1.085	0.278

***p<.05

Discussion and conclusion

This study was intended to investigate the relationship between school factors and teachers' self-regulated science teaching. 302 teachers from the 9 secondary schools were participated in responding the self-report questionnaires. A self-report self-regulated questionnaire was adapted from Capa-Aydine et al. (2009), a 35 self-report PLC questionnaire was also adapted from Olivier, Hipp, and Huffman (2010) as used by Heaton (2013) found from

http://dx.doi.org/10.29009/ijres.5.2.9

intermate, and the 22-science teaching resource availability for self-regulated teaching instrument was developed by the researcher. The reliability and validity of the instruments were checked and data obtained from the self-report was subjected to preliminary analysis. So, missing values were substituted using multiple imputation method (series mean method) and outliers were rounded to the next larger values not miss the subjects. The data were passed through principal component factor analysis and factors with eigen values greater than1 was retained for path analysis or SEM. The hypothesized theoretical model fit was checked using chi-square value and other fit indices and was found adequately fit to the data. Hence the following results were found.

First to check the correlation among school factors and self-regulated teaching, a Pearson correlation analysis was conducted; the result showed that professional learning community practice moderately and positively corelated with self-regulation(r=.47) and STRA is somewhat showed low positive correlation with SRST(r=.28). And the result of multiple regression analysis confirmed this relationship which indicts that PLC was a significant positive predictor of self-regulated teaching (Beta=.425, t (300) =7.66, p<.05 (300)) whereas STRA was not found significant predictor, t (300) = 1.934, p=.054. this study result is in line with that of Butler (2003) which says that teachers came to make shifts in their practice through participating in collaborative teaching and research with teams of fellow teachers and researchers. And with Inos and Quigley (1995); Gerten and Dimino(2001); Pressley and El-Dinary (1997); Richardso and Placier(2000) as cited in Lau (2013) indicated that administrative support from and a positive collaborative culture with in schools or supportive working environment encourages teachers with new instructional approach as indicated. And Cockpim & Somprachs' (2019) findings also

http://dx.doi.org/10.29009/ijres.5.2.9

indicated that learning, transformational, collaborative, and invitational leadership styles are the four significant predictors for promoting teachers' participation in professional learning community According to the study of Thoonen et al. (2011), as cited in Börü (2018), the school level of security, trustworthiness, incentive, and the level of cooperation and collaboration among staff motivates teachers to improve their teaching activities. The interface between collaborative construction of new teaching strategies while maintaining a focus on goals (curricular goals; promoting self-regulated processing), and opportunities to reflect on successes and problem-solving challenges in a succession of learning experiences cultural, social and individual processes in accounting for learning in authentic practice. So, the current study result and others informed us that where there is cooperative, collaborative, supportive learning, and reflective environments, teachers teaching efficacy for self-regulated teaching can be improved. But the study result is not congruent with Nolan (2009) who identified a negative correlation between school professional learning community and teachers' efficacy which is un usual. And Swigert (2012) examined the difference in self-efficacy of teachers who participated in PLC and those who did not to enhance use of innovative instructional strategies. The result of the study reveals that there is no difference among those groups.

Second, regarding to the relationship between science teaching resource availability and self-regulated science teaching the result of multiple regression and structural equation modeling did not show a significant impact of STRA on teachers' self-regulation. And this is not in line with the study results' of Corrigan and Taylor (2004); Martin (2017) and, Andersen, Dragsted, Evans.and Sørensen(2004) indicating that a resourceful environment increases teachers' motivation and confidence to practice innovative teaching strategies

http://dx.doi.org/10.29009/ijres.5.2.9

as a result an improved students' learning and achievement. Though it is logical and reasonable to say the presence of sufficient teaching learning resources motivates teachers to be creative, hardworking and efficient. Therefore, it needs farther investigation whether teachers' use of innovative teaching strategies like self-regulation increases with in the presence and absence of science teaching resources.

Conclusion

In this research, it was expected that school factors would have an impact on teachers' self-regulated teaching. However, it is only professional learning practice in the school has significant effect and correlation with the expected teacher desirable behavior. This has an impact on teachers' professional development including improving pedagogical skill. So, all concerned bodies particularly school leaders and principals should work strongly to create conducive and supportive collaborative professional learning environments and evaluate its impact continuously. Other interested researchers can conduct other investigation based on the limitations and results of this research using observation and interview approach.

http://dx.doi.org/10.29009/ijres.5.2.9

References

Achimugu, L. (2016). Factors affecting the effective implementation of senior secondary education chemistry curriculum in Kogi. International Journal of Scientific and Research Publications, 6(5), 562–566. ISSN 2250-3153

Aktam, H., & Acar, E. (2010). The effect of " laboratory practices in science teaching " course on development of prospective science teachers ' self-regulation skills, 2, 5549–5553. https://doi.org/10.1016/j.sbspro.2010.03.905

Andersen, A.M., Dragsted, S., Evans., R.H. & Sørensen, H. (2004). The relationship between changes in teachers ' self-efficacy beliefs and the science teaching environment of Danish first-year elementary teachers. Journal of Science Education, 15(1), 25–38.
URL: https://www.jstor.org/stable/43156328 Accessed:

Arrastia, M. C. (2015). The validation of the English language version of the teacher self-regulation. Unpublished Disertation Work.

Arslan, E. (2017). Self-efficacy as predictor of collective self-efficacy among preschool teachers in Turkey, 12(8), 513–517. https://doi.org/10.5897/ERR2017.3222

Ashebir Gogile and Bereket Alemayehu. (2019). The status of secondary school science laboratory activities for quality education in case of Wolaita Zone , Southern Ethiopia. Journal of Education and Practice, (April). ISSN 2222-288X (Online) .(7) 31,

Bembenutty, H., White, C. M., & Velez, M. R. (2018). Developing self-regulation of learning and teaching skills among teacher candidates. New York: Springer Dordrecht Heidelberg.

Bembenutty, H. (August 12, 2006). Teachers self-efficacy beliefs , Self-regulation of learning, and academic performance. Apaper Presented in Anual Meating, (718), 1–14.

Blitz, C. L., & Schulman, R. (2016). Measurement instruments for assessing the performance of professional learning communities.Washington,DC:Department of education. National Center for Education and Regional Assistance.

Börü, N. (2018). The factors affecting teacher-motivation. International Journal of Instruction, 11(4), 761–776.

Butler, D. L. (2003). Self-regulation and collaborative learning in teachers' professional development. Annual Meeting, (604). Retrieved from e-mail: deborah.butler@ubc.ca

Callan, G. L. (2014). Self-regulated learning (SRL) microanalysis for mathematical problem solving : a Comparison of a SRL Event measure , questionnaires , and a teacher rating scale. Unpublished Disertation Work, (May).

Capa-Aydin, Y., Sungur, S., & Uzuntiryaki, E. (2009). Teacher self-regulation :Examining a multidimentional construct. An International Journal of Experimental Educational Psychology, 29:3, 345–356. https://doi.org/10.1080/01443410902927825

Ching Mok, M. M., & Moore, P. J. (2019). Teachers & self-efficacy. An International Journal of Experimental Educational Psychology Psychology, 39(1), 1–3. https://doi.org/10.1080/01443410.2019.1567070

Cockpim, J., & Somprach, K. (2019). Learning leadership of school administrators and teaching behavior affecting The effectiveness of teacher professional development : Hierarchical linear model. The Turkish Online Journal of Educational Technology –, 18(2), 52–55.

Corrigan, G., & Taylor, N. (2004). An exploratory study of the effect a self-regulated learning environment has on pre-service primary teachers' perceptions of teaching science and technology. International Journal of Science and Mathematics Education, 2, 45–62.

De Smul, M., Heirweg, S., Devos, G. &, & Keer, H. V. (2018). School and teacher determinants underlying teachers ' implementation of self-regulated

http://dx.doi.org/10.29009/ijres.5.2.9

learning in primary education. Research Papers in Education, 00(00), 1–24. https://doi.org/10.1080/02671522.2018.1536888

Delfino, M., Dettori, G., & Persico, D. (2010). An online course fostering self-regulation of trainee teachers. Psicothema, 22, 299–305.

Fekede Tuli. (2015). Professional learning of teachers in Ethiopia : Challenges and implications for reform. Australian Journal of Teacher Education, 40(5).

Flick, L. B., & Lederman, N. G. (2006). Scientific inqiry and nture of science: Implication for teaching, learning and teacher education. (Eds., Ed.). USA.

Ghonsooly, B., & Ghanizadeh, A. (2011). Self-efficacy and self-regulation and their relationship: A study of Iranian EFL teachers. Language Learning Journal, 41(1), 68–84. https://doi.org/10.1080/09571736.2011.625096

Gol, A. K., & Royaei, N. (2013). EFL teachers ' self-regulation and job performance. Acaddemy Publisher, 3(10), 1855–1861. https://doi.org/10.4304/tpls.3.10.1855-1861

Habtamu Reta. (2017). Quality of science teaching in secondary schools of North Gondar Zone in Ethiopia. International Journal of Educational Science, 1122, 20–35. https://doi.org/10.1080/09751122.2017.1311592

Heaton, M. (2013). An examination of the relationship between professional learning community variables and teacher self-efficacy. Electronic Theses and Dissertations. 5038.

Hipp, K., & Huffman, J. (2010). Demystifying professional learning communities: School leadership at its best. Lanham, MD: Rowman & Littlefield Education.

Hord, S. M. (1997). Professional learning communities: Communitiess of Continuous inquiry and improvement. Southwest Education Devlopment Laboratory.

Lau, K. L. (2013). Chinese language teachers ' perception and implementation of self-regulated learning-based instruction. Teaching and Teacher Education, 31, 56–66. https://doi.org/10.1016/j.tate.2012.12.001

Lekhu, M. A. (2013). Assessing the teaching efficacy beliefs of science teeachers in seccondary schools in the free state province. Unpublished Disertation Work, (December).

Lombaerts, K., Engles, N., &Van B. J. (2009). Determinants of teachers ' recognitions of self -regulated learning practices in elementary education. Tayler & Francis, 102(3), 163–173.

Martin, E. N. (2017). Correlation between the availability of resources and efficiency of the School system within the framework of the implementation of Competency-based teaching approaches in Cameroon. Journal of Education and Practice, 8(2), 82–92.

Meyers, L. S., Gamst, G., & Guarino, A. J. (2006). Applied multivariate research design and interpretation. Sage publication Ltd.

Sackney, L. (Ed.). (2000). Profound improvement: Building capacity for a learning community. Swets & Zeitlinger.

Moafian, F., & Ostovar, S. (2012). Validation of the english version of the teacher self-regulation scale in an EFL context. Journal of Scientific Research, 6(April 2017). https://doi.org/10.5829/idosi.mejsr.2012.12.5.2478

Nolan, D. E. (2009). A study of the relationship of teachers ' self-efficacy and the impact of professional learning community as an organizational structure. Unpublished Disertation Work.

Oli Negassa. (2014). Ethiopan students' achievement challenges in science education:Implications to policy formulation. Online Submition, 4(1), 2–18.

Pareek, R. B. (n.d.). An assessment of availability and utilization of laboratory facilities for teaching science at secondary Level. Science Education International, 30(1), 75–81.

Peeters, J., Backer, F. D., Reina, V. R., Kindekens, A., Buffel, T. & Lombaerts, K. (2014). The role of teachers ' self-regulatory capacities in the implementation of self-regulated learning practices. Science Direct, 116, 1963–1970. https://doi.org/10.1016/j.sbspro.2014.01.504

Rennie, L. J., Goodrum, D., & Hackling, M. (2001). Science teaching and learning in Australian schools : Results of a National study. Research in Science Education, (7)31, 455–498. ISSN 2222-288X (Online)

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. MPR-Online, 8(2), 23–74. http://www.mpr-online.de

Schumacker, R. E., & Lomax, R. G. (2016). A biggner 's guide to structural equation modeling (4th ed.). New York,NY10017: Taylor & Francis.

Sweigart, D. P. (2012). Professional learning communities , self -efficacy , and collaborative learning in the elementary School. Unpublished Disertation Work.

Toussi, M.M., Boori, A.A., Ghanizadeh, A. (2011). The Role of EFL teachers ' self-regulation in effective teaching. World Journal of Education, 1(2), 39–48. https://doi.org/10.5430/wje.v1n2p39

Toussi, M. t., Boori, A. A., & Ghanizadeh, A. (2011). The role of EFL teachers ' self-regulation in effective teaching. World Journal of Education, 1(2), 39–48. https://doi.org/10.5430/wje.v1n2p39

Tschannen-Moran, M., & Mcmaster, P. (2009). An examination of the relationship between professional learning community variables and teacher self-efficacy, 110(2), 228–245.

URL: https://www.jstor.org/stable/10.1086/605771

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In Handbook of self-regulation (pp. 13-39). Academic Press.

Zimmerman, B. J. (2002). Becoming a self-regulated learner : An overview. Theory Into Practice, 5841(0040). https://doi.org/10.1207/s15430421tip4102