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Self-regulated learning among teacher education students: Motivational beliefs influence on the use of metacognition

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In the present study, we examined the relationships between motivational beliefs (self-efficacy, task value, and control of learning beliefs) and use of metacognitive learning strategies among teacher education students in Uganda. The sample comprised of 649 students selected from seven universities. Data were collected using several scales from the modified Motivated Strategies for Learning Questionnaire, and analysed using Structural Equation Modelling. Task value and self-efficacy independently and significantly predicted students' reported use of metacognition. Students' self-reported self-efficacy and task value explained 38% of the variance in their use of metacognition. The evidence suggests interventions aimed at improving teacher education students' metacognitive skills to focus on enhancing their efficacy and value beliefs.

Keywords: metacognition, motivational beliefs, motivated strategies for learning questionnaire, teacher education students

Introduction

Effective learning requires both skill and will on the part of the learner (Zusho, Pintrich, & Coppola, 2003). Skill and will in learning is premised on use of self-regulation strategies (Zimmerman, 2000). As applied to learning, self-regulation refers to the degree to which students are active participants in their own learning (Zimmerman, 2008). Aspects of self-regulation, such as motivational beliefs of self-efficacy, control of learning, task value orientation, and self-monitoring (metacognition) influence learning outcomes (Zimmerman, 2000). Previous studies have indicated that the relationship between motivational beliefs and metacognition is mediated by students' achievement goals (Diseth, 2011; Liem, Lau, & Nie, 2008), which implies that one's achievement goals have effects on his/her metacognition (Barzegar, 2012; Diseth, 2011). Understanding the interplay between attributes of students' motivational beliefs and learning is vital to instructional design. The present study examined the extent to which self-efficacy, task value, and control of learning beliefs predict metacognitive learning skills among Ugandan teacher education students.

Background to the study

The last three decades have seen an increasing emphasis on understanding the competences, skills, and attributes that individuals need in order to succeed in their professional and educational lives. Particularly, studies have focused on influences of learning of self-regulation related factors such as personal, non-cognitive skills of development of trustworthy, reliability, creativity, and independence (Duckworth, Akerman, MacGregor, Salter, & Vorhaus, 2009; Zimmerman, 2000, 2008). In reference to learning, self-regulation entails a student's motivational beliefs, his/her reported use of learning strategies, and self-evaluation upon academic outcomes (Zimmerman, 2008).

In educational settings, self-regulation is highly correlated with students' learning, academic success, and persistence in their studies (Pintrich & DeGroot, 1990). Self-regulatory learning strategies result in high possession of content knowledge, including its appropriate application (Corrigan & Taylor, 2004; Kramarski & Michalsky, 2009). This would be the case in professional preparation programs such as teaching (Endedijk, 2010).

Self-regulated learning

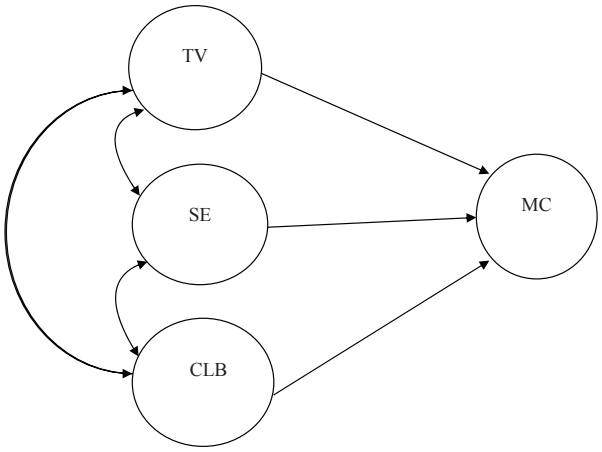
Zimmerman (2000) proposed a three-phase cyclic process of self-regulated learning consisting of the initial planning phase, performance phase, and reflection phase. During the planning phase, learners engage in task analysis, in which they break down complex learning material into smaller manageable and achievable learning tasks. They are motivated in their learning task engagement by their self-beliefs as learners, control of learning beliefs, and also their task value orientations (Diseth, 2011; Liem et al., 2008; Pintrich & DeGroot, 1990; Şen & Yilmaz, 2016; Yusuf, 2011). In the performance phase, learners apply task appropriate strategies to synthesise and integrate various forms of knowledge; for instance, they may use deep learning strategies such as metacognition in solving complex problems. Metacognition involves the ability to think about and critique one's own cognitions (Flavell, 1978), and is highly associated with academic success (Pintrich & DeGroot, 1990; Zimmerman, 2000). During the self-reflection phase, learners make attributions for their success or failures, which are important for their future learning and task choice.

Many of the studies on self-regulated learning among teacher education students have been conducted in Europe

(e.g., Donche & Van Petegem, 2009; Endedijk, 2010; Endedijk, Brekelmans, Veerloop, Sleegers, & Vermunt, 2014; Heikkilä, Lonka, Nieminen, & Niemivirta, 2012) and the United States (e,g., Bembenutty, 2007; White & Bembenutty, 2013). The major exceptions include the studies by Taura, Abdullah, Roslan, and Omar (2015) in Nigeria, Şen and Yilmaz (2016) in Turkey, and Mousoulides and Philippou (2005) in Cyprus. Taura and colleagues (2015) examined the relationships between task value, self-regulated learning strategies, and active procrastination among 426 pre-service teachers. Their findings indicated that students who held to a high sense of self-efficacy and task value orientation had superior task engagement and timeliness of task completion, as compared to peers. Mousoulides and Philippou (2005) reported that task value orientation significantly predicted use of self-regulated learning strategies among teacher education students in Cyprus. More recently, Şen and Yilmaz (2016) have also reported positive correlations between pre-service teachers' meta-cognitive learning strategies and (i) control of learning beliefs and (ii) self-efficacy. Furthermore, a path analysis indicated that self-efficacy and control of learning beliefs had significant effects on the students' metacognitive skills. Studies are needed on self-regulated learning attributes in the Ugandan setting focusing on the extent to which motivational beliefs contribute to metacognition among teacher education students, in order to clarify the relations reported by the international studies.

Present study

The present study aimed to examine the relationships between motivational beliefs and use of metacognition among Ugandan teacher education students. It sought to address the question: To what extent do motivational beliefs predict metacognition among teacher education students in Uganda? As such, we tested the conceptual model indicated in Figure 1.



Note. TV = Task value; SE = Self efficacy; CLB = Control of learning beliefs; MC = Metacognition

Figure1. Conceptual model showing the relationships between motivational beliefs and metacognition

Method

Participants and setting

A total of 649 undergraduate students from seven universities were participants (females = 21.3%; mean age = 22 years, SD = 2.17 years). Many of the students were on private sponsorship (354 students, 54.5%) while the rest had some form of scholarship. The majority of the students were in their first year (271 students, 41.8%).

Instrument

We assessed students' motivational beliefs and metacognition using different subscales from the modified Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991). Specifically, we used three subscales from the motivational beliefs' section (i.e., task value, self-efficacy, and control of learning beliefs sub-scales) and one subscale (i.e., metacognition sub-scale) from the learning strategies' section of the MSLQ. Details of these subscales are described below.

Task value

We assessed the students' evaluation of how important their studies are using the 6-item task value subscale (Cronbach's $\alpha = 0.77$). Example items included:

- It is important for me to learn the course material in this degree program.
- I am very interested in the content area of degree program.
- I think the course material in this class is useful for me to learn.
- I like the subject matter of this degree program.

Control of learning beliefs

We assessed the students' beliefs that academic outcomes are contingent upon their own efforts using the 4-item control of learning beliefs sub-scale (Cronbach's $\alpha = 0.58$). Example items included:

- If I study in appropriate ways, then I will be able to learn the material in this program.
- It is my own fault if I don't learn the material in this program.
- If I try hard enough, then I will understand the course material.

Self-efficacy

Self-efficacy was assessed using the 6-item (Cronbach's $\alpha = 0.79$) self-efficacy for learning and performance sub-scale. Examples of items in this sub-scale included:

- I believe I will receive an excellent grade in this class.
- I'm certain I can understand the most difficult material presented in the readings for this program.
- I'm confident I can understand the basic concepts taught in this program.

Metacognition

We assessed students' awareness, knowledge, and control of cognition using a 10-item metacognition sub-scale (Cronbach's $\alpha = 0.80$). Examples of items on this sub-scale included:

- When reading for this course, I make up questions to help focus my reading.
- When I become confused about something I'm reading for this class, I go back and try to figure it out.
- If course materials are difficult to understand, I change the way I read the material.
- Before I study new course material thoroughly, I often skim it to see how it is organised.
- I ask myself questions to make sure I understand the material I have been studying in this class.

Procedure

Ethics clearance for the study was obtained from the Institutional Review Board of Mbarara University of Science and Technology and the Uganda National Council of Science and Technology. The students consented for the study. They completed the MSLQ during lecture time. The first author explained the purpose of the study and the likely benefits of the study findings to the respondents. Two research assistants assisted with the data collection. Students took 15 to 20 minutes to complete the questionnaire.

Data analysis

The present study employed Structural Equation Modelling (SEM), using latent variables, to examine the relationships among the students' motivation beliefs and use of metacognition. We created item parcels for the different latent variables, and, these parcels acted as their manifest variables. Item parcels were created using the odd-even method (Wang & Wang, 2012). Our analytic procedure followed three stages including (i) initial data screening, (ii) assessment of the measurement model, and (iii) fitting of the structural model. Details of these stages are further explained in the next sections. In assessing the measurement model and fitting the structural models, we assessed model fits using the fit indices including the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). A combination of the above fit indices minimises Type 1 and Type 11 errors (Hu & Bentler, 1999). We followed the model fit criteria suggested by Hu and Bentler (1999), who suggested CFI/TLI values close to 0.95, SRMR $\leq$ 0.08, and RMSEA $\leq$ 0.06 to indicate good fit. All analyses were conducted in Mplus 7.4 (Muthén & Muthén, 1998–2015) using the maximum likelihood estimator.

After testing the measurement model, we proceeded to fit the structural paths in the model. In the final model, we also tested the combined effect of different motivational beliefs on metacognition. This analysis was important in order to assess whether motivational beliefs contributed to students' use of metacognition independent of one another, or whether they had an interaction effect on metacognition.

Results

Descriptive statistics for the variables used in the analysis

Metacognition was significantly positively correlated with control of learning beliefs, task value, and self-efficacy (see Table 1). These correlations imply that students with high control over their learning beliefs, high belief in their competencies to accomplish academic tasks, and who attached high importance to their studies, highly employed metacognitive learning strategies in their studies.

Assessment of the measurement model

We observed an excellent fit between the data and the proposed measurement model as indicated by the fit indices (RMSEA = 0.043; CFI = 0.991; TLI = 0.982; SRMR = 0.051; and 90% CI = 0.022, 0.064). Since the fit indices were well above the acceptable values, there was no need to modify the model. All factor loadings for the manifest variables ranged between 0.42 and 0.88, and were significantly ($p < 0.001$) above 0.30, as recommended by Hair, Anderson, Tatham, and Black (1992). As such, the manifest variables significantly explained the underlying latent variables assessed in the study. These findings are fully illustrated in Figure 2.

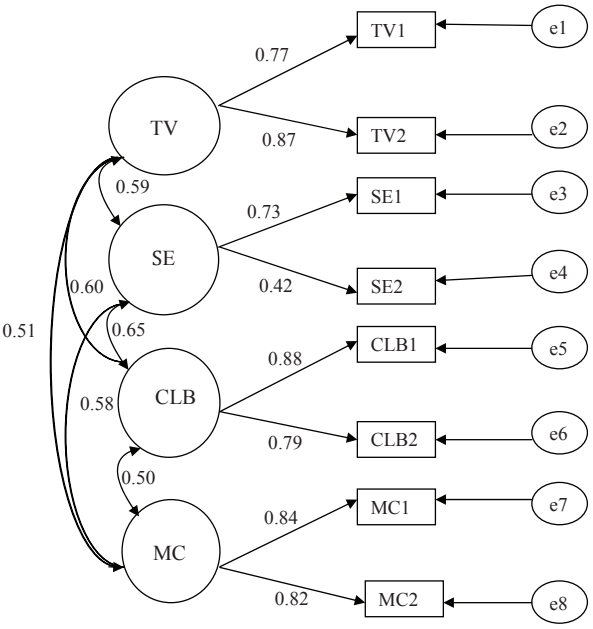
Assessment of the structural model

As indicated in the analytic procedure above, the structural model was fitted after assessing the measurement model. Fitting in of the structural paths did not change the model

Table 1. Descriptive statistics, Skewness, Kurtosis, and correlation matrix for the variables used in the analysis

Variable	TV1	TV2	CLB1	CLB2	SE1	SE2	MC1	MC2
TV1								
TV2	0.67**							
CLB1	0.28**	0.41**						
CLB2	0.18**	0.21**	0.31**					
SE1	0.44**	0.44**	0.42**	0.25**				
SE2	0.35**	0.40**	0.37**	0.24**	0.70**			
MC1	0.35**	0.38**	0.29**	0.19**	0.42**	0.39**		
MC2	0.33**	0.33**	0.32**	0.15**	0.42**	0.39**	0.69**	
Mean	5.72	5.96	5.83	4.46	5.96	5.50	5.24	5.49
SD	1.38	1.07	1.40	3.12	0.75	1.07	1.23	1.10
Skewness	-1.12	-1.26	-1.32	-0.37	-1.00	-0.71	-0.53	-0.70
Kurtosis	0.24	1.50	1.72	-0.78	0.80	0.02	-0.27	0.15

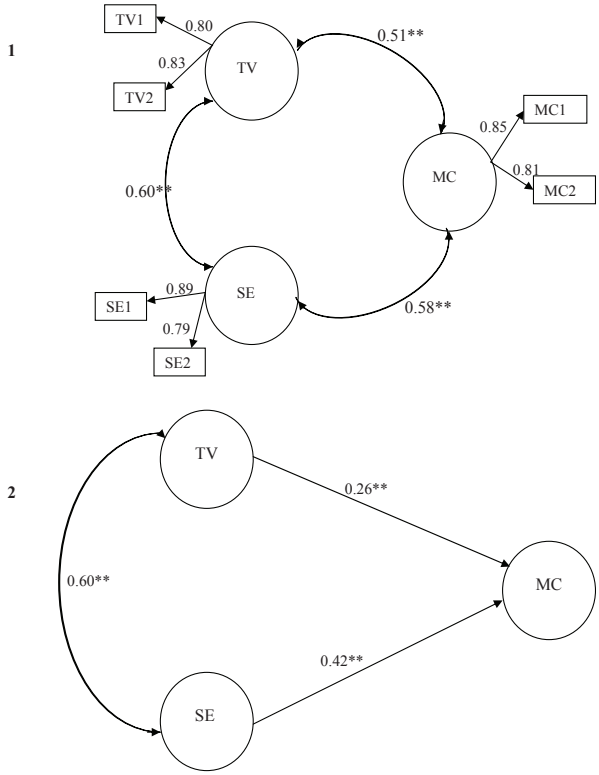
Note. TV1 = Parcel 1 for task value; TV2 = Parcel 2 for task value, CLB1 = Parcel 1 for control of learning beliefs; CLB2 = Parcel 2 for control of learning beliefs; SE1 = Parcel 1 for self-efficacy; SE2 = Parcel 2 for self-efficacy; MC1 = Parcel 1 for metacognition; MC2 = Parcel 2 for metacognition. **$p < 0.01$



Standardised parameters estimated are shown in the model.

Note. TV1 = Parcel 1 for task value; TV2 = Parcel 2 for task value, CLB1 = Parcel 1 for control of learning beliefs; CLB2 = Parcel 2 for control of learning beliefs; SE1 = Parcel 1 for self-efficacy; SE2 = Parcel 2 for self-efficacy; MC1 = Parcel 1 for metacognition; MC2 = Parcel 2 for metacognition; MC = Meta cognition; CLB = Control of learning beliefs; SE = Self efficacy; e1 – e8 = measurement errors

Figure 2. Measurement model for the latent variables that were included in the structural model



Observed variables for model 2 are the same as for the model 1. Standardised parameter estimates are shown in the models above

Note. TV = Task value; MC = Metacognition; SE = Self efficacy

The factor loadings in model 1 have slightly changed from those in Figure 2 because control of learning beliefs was removed from the prediction model

$^{**}p < 0.05$

Figure 3. Task value and self-efficacy as predictors of metacognition

fit indices, and the model fitted our data very well. However, the standardised model results indicated that the path from control of learning beliefs to metacognition (β = 0.14, $p = 0.111$) was not statistically significant, and hence was removed, and the structural model estimated again.

The revised model (RMSEA = 0.025; CFI = 0.998; TLI = 0.996; SRMR = 0.009; and 90% C = 0.000, 0.061) fitted much better than the initial model as indicated by the SRMR and RMSEA values close to zero. Comparisons of these models (one after removal of the non-significant path and another before removal of the non-significant path) using a chi-square difference test, indicated no significant differences between the two models. Additionally, this final model was more parsimonious, as it used few parameters to indicate the relationships between the study variables. Therefore, we report the standardised results of this modified model below.

Task value, self-efficacy, and metacognition

As shown in Figure 3 (model 1), the relationships between task value, self-efficacy, and metacognition were statistically significant. Self-efficacy and metacognition shared 33.6% of the variance ($R^2 = 0.58$). Metacognition and task value shared 26% of common variance ($R^2 = 0.51$), while self-efficacy and task value shared 36% of the variance ($R^2 = 0.60$). These results indicate that self-efficacy was a single, stronger explanatory factor of metacognition than task value among the Ugandan education students.

Relative contribution of task value and self-efficacy on use of metacognition

By analysing the R^2 increments based on the comparison of variability in metacognition shown in models 1 and 2, we were able to compute the unique contributions of task value and self-efficacy beyond and above each other. In model 2, both task value and self-efficacy accounted for 38% of the variance in metacognition. As such, task value contributed an additional 4.4% ($\Delta R^2 = 0.38 - 0.336 = 0.044$) of the variance in metacognition, beyond the single self-efficacy explanatory factor. The unique contribution of self-efficacy in predicting metacognition beyond the task value factor was 12% ($\Delta R^2 = 0.38 - 0.26 = 0.12$). These results further confirm that the contribution of self-efficacy on predicting metacognition was higher than that of task value.

We also examined the unique contribution of task value and self-efficacy on metacognition by constraining each of the related beta weights to zero and then evaluating the corresponding χ^2 changes in model 2. A significant decrease in the χ^2 upon constraining the beta weights to zero would indicate that the unique contribution of each variable in predicting metacognition is significant. Constraining beta weights to zero in both model 2a ($\beta_{\text{task value}} = 0$) and model 2b ($\beta_{\text{self efficacy}} = 0$) resulted in significant χ^2 changes (model 2a ($\beta_{\text{task value}} = 0$): $\Delta\chi 2$ (1, $n = 649$) = 19.57, $p < 0.05$; model 2b ($\beta_{\text{self efficacy}} = 0$): $\Delta\chi^2$ (1, $n = 649$) = 51.26, $p < 0.05$). The

Table 2. Goodness of fit indices

	χ^2	df	CFI	TLI	RMSEA
Model 1 and 2	8.47	6	0.998	0.996	0.009
Model 2a ($\beta_{\text{task value}} = 0$)	28.04	7	0.987	0.972	0.037
Model 2b ($\beta_{\text{self efficacy}} = 0$)	59.73	7	0.967	0.930	0.060

results indicated the significant unique contribution of task value and self-efficacy as predictors of metacognition. The fit indices are presented in Table 2.

Task value and self-efficacy interaction effects on use of metacognition

Lastly, the interaction effect ($\beta = 0.06$, $p = 0.079$) between task value and self-efficacy on metacognition was not statistically significant. Therefore, it implies that task value and self-efficacy contributes to students' metacognition independently of one another.

Discussion

In the present study, we examined the relationships between motivational beliefs and meta-cognitive learning strategies among Ugandan teacher education students. Findings indicated that task value and self-efficacy independently and significantly contributed to the students' reported use of metacognition. However, control of learning beliefs could not predict students' metacognitive skills in the current sample. Similarly, the combined effects of task value and self-efficacy did not have any significant contribution to the students' reported use of metacognitive learning strategies.

Our results about the positive effect of self-efficacy and task value on metacognition confirm previous findings from the international community (Diseth, 2011; Berger & Karabenick, 2011; Kassab, Al-Shafei, Salem, & Otoom, 2015; Liem et al., 2007; Neuville, Frenay, & Bourgeois, 2007; Sadi & Uyar, 2013; Stegers-Jager, Cohen-Scholtanus, & Themmen, 2012; Şen & Yilmaz, 2016). Findings are likely explained by the fact that students who believe in their abilities to achieve their academic goals are more likely to use a variety of cognitive and metacognitive strategies (see also Pintrich & DeGroot, 1990; Zimmerman, 2000), and tend to be task persistent compared to peers with lower self-beliefs (see also Bembenutty, White, & Vélez, 2015; Pajares, 2002). Highly efficacious students engage on academic tasks with serenity, while low efficacious students exhibit great apprehension in their studies (Pajares, 2002).

Our finding regarding the lack of effect of control of learning beliefs on metacognition contradicted recent findings by Şen and Yilmaz (2016). Some students may believe their academic success to depend upon their lecturers (as the lecturers provide the final grade). If such external locus of control beliefs were widespread among Ugandan teacher education students, then their control of learning beliefs would not predict metacognition, as was the case in the present study.

Implications for self-regulation supports with higher education students

There is need to support students in their beliefs to control own leaning outcomes rather than for them to believe that their learning outcomes are controlled by external factors such as the lecturers awarding subject grades. Educating learners to attribute achievements to their own efforts leads to stronger learning motivation (Schunk, 1987); thereby engaging in use of more learning strategies. Instructors should also assist learners to develop short term (proximal) goals which are more digestible and achievable for the learners, and also have an advantage of increasing their self-efficacy and control over learning (Pajares, 2002). Moreover, when learners' attach a lot of importance on study material, they are cognitively more engaged in learning compared to when they view a task as being irrelevant and useless. Students with high task value are more likely to engage in critical thinking and use of variety of deep learning strategies in their studies.

Additionally, teacher-trainees' self-efficacy can be enhanced by providing them with immediate and frequent feedback about their academic achievement, and helping them to make adaptive causal attributions while they are working on academic tasks. Previous studies have demonstrated that provision of immediate feedback convey a sense of mastery to the learner (Pajares, 2002), and improves on students' achievement and efficacy to accomplish a given task (Bandura & Schunk, 1981; Schunk, 1983).

Limitations of the study

Firstly, the variables included in the model only explained 38% of the variance in students reported use of metacognitive learning strategies, implying that there is a number of factors not investigated in the present study that account for the remaining 62% of the variance in students' metacognition. Secondly, this was a cross-sectional study, and no causal explanations were intended. Thirdly, only using of self-report measures may have misrepresented the actual use of self-regulated learning by the students. Fourth, findings from our study may not generalize to other students' populations across Uganda. We recommend that replication studies should be carried out with other student populations to ascertain whether the same structural relationships may exist.

Conclusion

The study has highlighted that self-efficacy and task value independently and significantly contribute to metacognitive skills of teacher education students. Self-efficacy accounted for 33.6% of the variance in students' metacognition; while, task value accounted for 26% of the variance. In order to boost metacognitive skills among

teacher education students, there is need to enhance their efficacy beliefs and task value through improving their goal setting skills, providing them with regular feedback on their academic progress, connecting study material with real-life experiences, and attribution training.

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