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Interactions between learner's beliefs, behaviour and environment in online learning: Path analysis

Enjy Abouzeid[1], Rebecca O'Rourke[2], Yasser El-Wazir[1], Nahla Hassan[1], Rabab Abdel Ra'oof[1] & Trudie Roberts[2]

[1]Faculty of Medicine, Ismailia, Egypt; [2]LIME, University of Leeds, United Kingdom

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Abstract

Introduction: Although, several factors have been identified as significant determinants in online learning, the human interactions with those factors and their effect on academic achievement are not fully elucidated. This study aims to determine the effect of self-regulated learning (SRL) on achievement in online learning through exploring the relations and interaction of the conception of learning, online discussion, and the e-learning experience.

Methods: A non-probability convenience sample of 128 learners in the Health Professions Education program through online learning filled-out three self-reported questionnaires to assess SRL strategies, the conception of learning, the quality of e-Learning experience and online discussion. A scoring rubric was used to assess the online discussion contributions. A path analysis model was developed to examine the effect of self-regulated learning on achievement in online learning through exploring the relations and interaction among the other factors.

Results: Path analysis showed that SRL has a statistically significant relationship with the quality of e-learning experience, and the conception of learning. On the other hand, there was no correlation with academic achievement and online discussion. However, academic achievement did show a correlation with online discussion.

Conclusion: The study showed a dynamic interaction between the students' beliefs and the surrounding environment that can significantly and directly affect their behaviour in online learning. Moreover, online discussion is an essential activity in online learning.

Keywords: *Online Learning, Conception of Learning, E-learning Experience, Human-Computer Interface, Self-regulated Learning, Path Analysis*

Practice Highlights

- The learner who views learning as a constructive process will show better use of self-regulated learning strategies.
- Learners' beliefs and perceptions can shape the learning experience.
- Online discussion can directly and significantly affect academic achievement in online learning.
- Self-regulated learning is responsible for a small portion of the change in academic achievement.
- Online discussion may affect self-regulated learning negatively.

I. INTRODUCTION

In just a few years, online e-learning has become part of the mainstream in medical education for postgraduates in both developed and developing countries. The use of online e-learning may provide solutions for many educational problems, especially for health professions graduates. It can help them achieving their developmental and educational goals despite the lack of time and overburdened schedules. This raised the need for better understanding of learning in online learning context.

The training that most schools offer to students and instructors on online leaning is mainly limited to using technologies that allow learners to interact with instructors and other learners effectively and flexibly. However, learners in online learning are facing several and complex challenges due to the nature of this context. Online learning is a form of distance learning that represent not only the access to learning experience via the use of technology and internet but also it relies on connectivity, flexibility and ability to promote varied interactions (Hiltz & Turoff, 2005). It characterised by autonomy and relative isolation due to the lack of face-to-face support. One of these important challenges is the need for self-regulated skills. It has been reported that these skills are more important in online learning as compared to traditional one (Azevedo et al., 2008).

Self-regulation is defined as the degree to which students are metacognitively, motivationally, and behaviourally active participants in their learning process (Zimmerman, 1986). This definition focused on students' proactive use of specific behaviours to improve their academic achievement. In short, the ability to regulate one's learning process is a critical skill to achieve personal learning objectives in online courses due to the absence of the support and guidance that is typically available in face-to-face learning environments (e.g., an instructor setting deadlines and structuring the learning process). Therefore, online learners need to determine when and how to engage with course content without any other support than the course content and structure, which can pose a challenge for many learners (Lajoie & Azevedo, 2006).

Hence, it seems reasonable to assume that SRL may be a reliable predictor of academic performance. It has been shown that self-regulated learners are more effective learners (Toering et al., 2012), who attain higher grades in medical education (Lucieer et al., 2016). However, the effect of SRL on academic achievement in online learning is still unclear.

Several factors may interact and affect learning in online learning. However, some had received only limited discussion in the medical education literature while others had relatively little empirical testing. Although several research studies have investigated the effect of conception of learning on learners' approaches, efforts, and motivation, however the effect of conception of learning on self-regulation is still insufficiently explored. Moreover, it can be assumed that students in online learning context may show different conceptions of learning as studies have shown that conception of learning is a context-depended construct that may differ according to the domain of the study or the surrounding context (Chiu et al., 2016; Tsai & Tsai, 2014). Additionally, SRL processes depend on both the learner and the surrounding environment (Bembenutty, 2006). As a result, we assumed that the learners' perception of the quality of the surrounding learning environment might directly affect their behaviour and outcomes. In other words, the quality and interactivity of the learning environment may shape the learners' attitude towards the learning experiences and influence the behavioural control of the learner (Zhao, 2016).
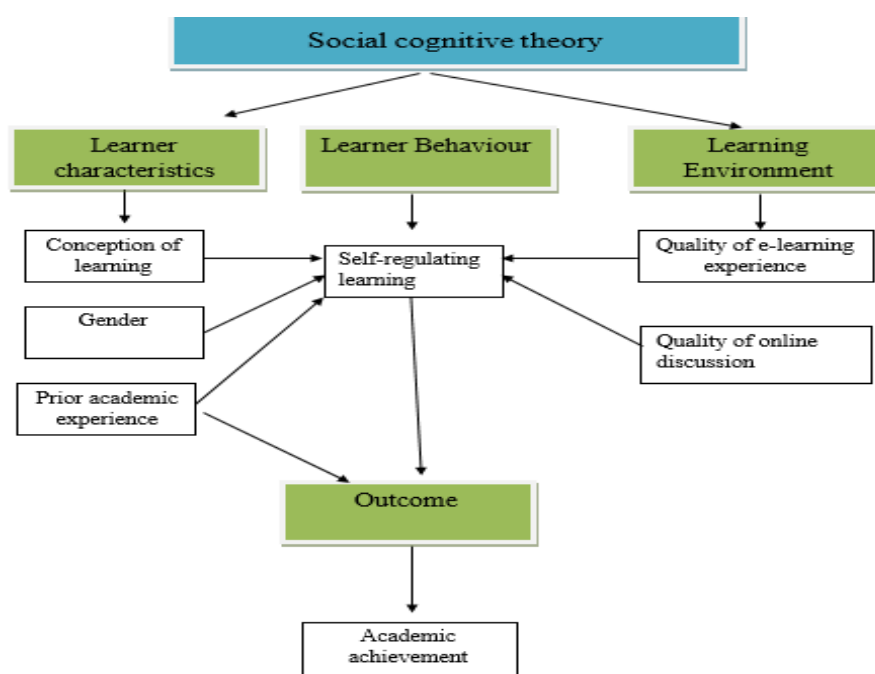

Figure 1: The study conceptual framework

Therefore, a model was hypothesized to explore the interaction between self-regulated learning, the conception of learning, online discussion, and the e-learning experience in an online environment, and how this interaction may affect academic achievement. This cross-sectional study provides an exciting opportunity to advance our knowledge about the learning process in online learning by raising the following questions:

1. What is the relationship between SRL and academic achievement in online learning?

2. What are the interactions between personal characteristics, beliefs, behaviours, and environment in online learning?

3. Does these interactions affect academic achievement in online learning?

II. METHODS

A. Type of the Study and Setting

An observation cross-sectional study was performed at the Faculty of Medicine, Suez Canal University, Egypt. The Medical Education Department offers postgraduate online learning programs in Medical Education to the graduates of Health Professions Education specialties. The program is one of the first online programs in health professions education in the Arab region. It is a two-year program in which students submitted weekly assignments through Wordpress / Eleum and receive online feedback on the same Learning Management system (LMS). Also, participate in an online discussion forum through the web-based application Listserv on Google group.

B. Participants and Sampling

'Out of 231 learners in the online program, a non-probability convenience sample of 128 learners was recruited in the current study; of which, 88 participants had an input in the online discussion'. The subjects were selected from all the program fellows based on their approval to be included in the study sample. The participants were asked to participate in the study through a mass email composed of a detailed description of the nature of the study, the purpose of the study and its relevance to the field of medical education. In all cases, fellows were informed that any information they included in the questionnaires would be treated with confidentiality.

C. Data Collection Tools

Instruments were selected in the current study because it was constructed and used in relevant contexts and the design of the final version of the questionnaires were validated using factor; reliability and test- retest analysis.

1) *Measuring learners' self-regulated learning:* The Online Self-Regulated Learning Questionnaire (OSLQ) was used to measure the self-regulated learning behaviours of the fellows (Barnard et al., 2008). The OSLQ consists of six subscale constructs including: environment structuring; goal setting; time management; help seeking; task strategies; and self-evaluation.

2) *Measuring learners' conception of learning*: The mental model section of the Inventory of Learning Style (ILS) was used to explore the learners' conception of learning. The questionnaire was kindly provided by J.D. Vermunt, who originally developed this inventory (Vermunt, 1998). The conception of learning section is composed of 25 items categorised under five scales: construction of knowledge, intake of knowledge, use of knowledge, stimulating education & cooperation of learning.

3) *Measuring of the quality of e-learning experience*: The e-Learning Experience Questionnaire was used to explore the role of the learning environment (Ginns & Ellis, 2007). The questionnaire consisted of subscales which would reflect students' perceptions of Good Teaching, Good Resources Clear Goals and Standards, Appropriate Assessment, Generic skills, Appropriate Workload and student interaction.

4) *Online discussion*: The assessment of the fellows' input in the online discussion was done by using a scoring rubric that was included in a framework proposed by Nandi et al. (2009). This framework defines several themes on which qualitative online interaction can be designed and assessed. The scoring rubric composed of three broad categories: content, interaction quality and participation.

5) *Academic achievement*: The fellows' final grade is the sum of the educational units' mean which, in turn, is the sum of the unit assignments' mean was used as an indicator of academic achievement. The academic achievement was categorized into four categories according to the final mean of the units: excellent: means 9-10, very good: means 8, good: means 7 and pass: means 6 and fail means > 6.

III. RESULTS

Data analysis was conducted using Statistical Package for the Social Sciences (SPSS®) version 20 software and International Business Machines SPSS Amos™ version 20. Out of the 231 learners in the Health Professions Education program through distance learning, 128

postgraduate learners were included in the study. The sample composed of 40 males and 88 female learners. Furthermore, they were divided according to their previous academic rank into 2 groups (Dr: 69 & Prof: 59 students). Student t-test revealed that there is no significant difference between male and female in SRL, $t(126) = 1.43$, conception of learning, $t(126) = 0.13$, quality of E-learning experience, $t(126) = 0.78$, online discussion, $t(126) = -1.46$ and academic achievement, $t(126) = -0.79$, $p<0.05$.

	CONCEPTION of LEARNING	E_EXPERIENCE	Online discussion	SRL	Academic achievement
CONCEPTION of LEARNING		.365**	.012	.189**	-.024
E_EXPERIENCE			.247**	.430**	.140
Online discussion				-.032	.279**
SRL					.054
Academic achievement					

Table 1: Correlation between SRL, quality of e-Learning experience, conception of learning, online discussion and academic achievement using Pearson's product moment correlation.

Table 1 shows that SRL have a statistically significant relation with Quality of e-Learning experience, conception of learning while there was no correlation with academic achievement and online discussion. However, academic achievement showed correlation with online discussion.
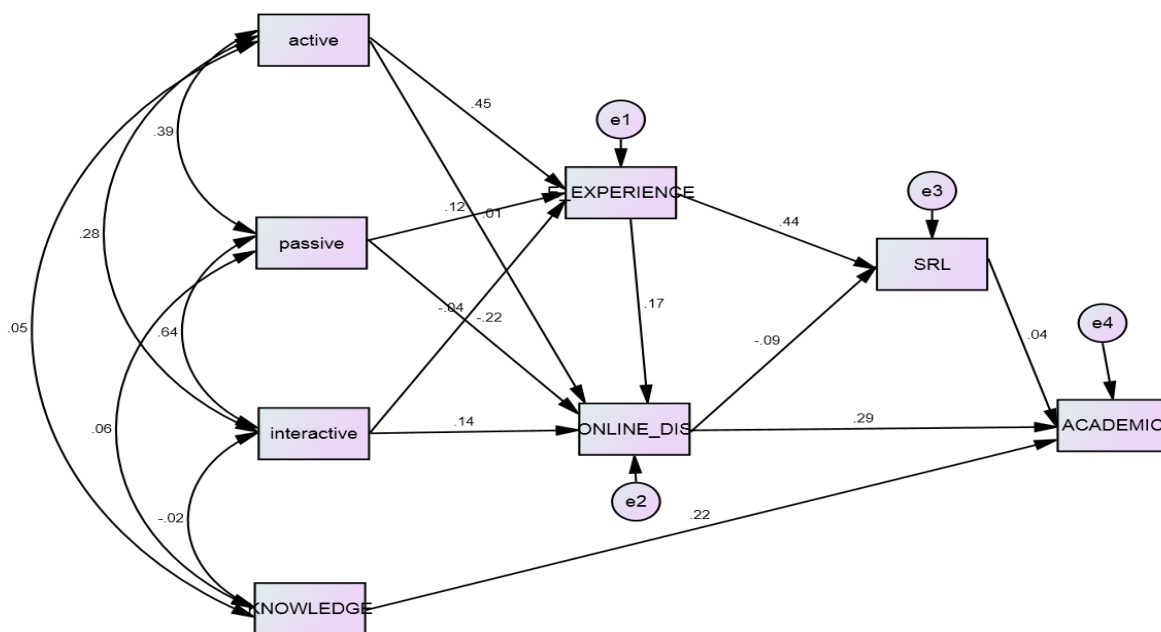

Figure 2: Path analysis for the relationships between SRL, quality of e-Learning experience, conception of learning, online discussion, and academic achievement[1].

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[1]Active: active conception of learning group (Use of knowledge & Construction of knowledge), Passive: passive conception of learning group (Intake of knowledge), Interactive: interactive conception of learning group (Stimulating of learning & Cooperation), Knowledge: Prior academic experience, E-experience: Quality of e-Learning experience, Online_dis: Quality of online discussion, SRL: Self-regulating learning, Academic: Academic achievement and *** : statistical significance difference at the p= 0.05 level

Figure 1 illustrates a summary of the conceptual path model created between the different study variables. The model showed a good fit between a good fit between the tested model and the data ($\chi2= 5.84$, df =10, $\chi2$/df =0.584, The Goodness of Fit Index (CFI =1.00), The Normed Fit Index (NFI =0.96), The Root Mean Square Error of Approximation (RMSEA =0.00). Some path coefficients were statistically significant ($p < 0.05$) and some paths also demonstrated practical significance ($\beta > 0.3$).

Quality of e-experience is directly affected by the active conception of learning ($\beta = 0.45$). SRL is affected directly by quality of e-experience ($\beta = 0.44$) and

indirectly affected by active conception of learning. Finally, the online discussion is negatively affected SRL ($\beta = -0.09$). Academic achievement is directly influenced by online discussion ($\beta = 0.29$) and prior experience/academic rank (knowledge) ($\beta = 0.22$). However, SRL has a small effect on academic achievement (0.04).

IV. DISCUSSION

At this time of transformative change in the use of technology in medical education, it is recommended to study how online learning can be improved in terms of the inter-relationship of conception of learning, self-regulated capacity and learner's achievement. This study is of high relevance to all medical schools that adopt or plan to incorporate online learning in their curricula. It is noteworthy that many medical schools in the Asia Pacific region are increasingly adopting online learning in their programs as it may solve some medical education challenges in the region (Karunathilake & Samaraskera, 2019).

The results of the path analysis have revealed that conception of learning, quality of e-learning experience and online discussions are significant factors for learning in online context. Despite previous studies having explored the effect of satisfaction and SRL (Liaw & Huang, 2013) however, the link between conceptions of learning, perception of e-learning experience and SRL was discussed in only a very few studies so far (Kassab, et al., 2015; Zhao & Chen ,2016).

The developed model has gained advantage through confirming that as student perceptions of the quality of e-learning experience becomes more positive their self-reported degree of self-regulation in online learning also increases. It can be explained as the students' positive perception of satisfaction and usefulness from different dimensions of the e-learning experience may help them in applying positive behaviours because they are motivated and enjoying the learning experiences. This supports researchers who have concluded that user satisfaction and self-regulation are highly correlated in e-learning environments (Liaw & Huang, 2013).

Additionally, the findings of this study added that the active conception of learning only are positively and significantly related to quality of learning experience and SRL. This relation should be tracked to the role of conceptions of learning in the students' learning approach. Students with active conception of learning will adopt deeper approaches that in turn will foster the learner -content interaction. This interaction will affect

student motivation and satisfaction (Barger et al., 2016; Tsai P. S., et al., 2011).

These current findings indicate that as students' active conception of learning become more positive, their self-regulation indirectly improves. This point was tested by the current COVID-19 pandemic that revealed that students can take learning into their own hands. Enforced online learning is showing everyone that students can play a much more proactive role in content discovery and assume more responsibility for their own growth as learners. In other words, when the students' perception of learning had changed, they own the reins of their learning (Ciotti, 2020). It was also supported by extant research literature. Loyens et al. (2008) found structural positive relations between students' constructive conceptions of learning on the one hand and their use of deep processing and self-regulation strategies on the other. Moreover, the learning conceptions 'construction of knowledge' was negatively related to external regulation and lack of regulation.

However, the findings did not show significant relation between SRL and academic achievement. The current study confirmed that some variation in learners' performance could be explained by the students' self-regulated learning skills. Nevertheless, this finding can be explained by the importance of introducing SRL skills explicitly in the learning objectives and syllabus with enough space for the learners to develop and apply SRL skills during the program activities. Self-regulated learning skills need to be taught (Zimmerman, 1989) and learners should be provided with appropriate instructions to guide them to develop and apply SRL skills. It may be expected that senior or postgraduate leaners can develop these skills alone because there is correlation between maturity and SRL skills (Premkumar, et al., 2013; Reio & Davis, 2005). However, studies showed that the use of learning strategies is domain-specific and a learner who is highly self-regulated in one situation may be very much less self-regulated in a new and unfamiliar context (Fisher et al., 2001). Therefore, it seems important that learners need be trained to extend their metacognitive knowledge base and make it more coherent in both under and post graduate learning.

It is interesting to note that there was a statistically significant relation between online discussion and academic achievement. The study program provides an interactive learning environment through the listserv activity. It is an interactive multiple-edged activity that can foster different types of interactions; learner-learner, learner-instructor, and learner- content. These interactions are assumed to affect the learners' behaviours and achievement positively. Therefore, the

social interaction may be crucial element in the formation of online learning communities. As demonstrated by previous studies these interactions will enhances the individual's regulation of cognition, metacognition, behaviour, and motivation which in turn affects the achievement (Alzahrani, 2017; Delaney et al., 2019).

Given this, it is somewhat surprising that online discussion negatively affects online self-regulation. Students needs to be deeply involved in online discussion so they can plan, monitor, and reflect upon their interactions with other students (Delen & Liew, 2016). But the negative relation between online discussion and SRL shows that students may not be engaged in deep-level interaction with other students for knowledge creation. Instead, many online students participate minimally in discussions only to meet participation requirements (Hew et al., 2010). In the current study, 42% of the participants were evaluated as satisfactory while 1% as excellent. Moreover, 32% of the participants had no input in the discussion.

Additionally, the design of the online forum, especially the proportion of online interactions required for assessment purposes and how the online discussion is evaluated, may also be a factor in the results. The small portion that the evaluation of the online discussion contributes to the final grade in the current study may cause the students not to take online interaction with other students seriously. This point was also reported by Cho & Cho, (2017), who found online discussion is often evaluated by the h number of posts and accounts for 10% of the total grades.

A. Study Limitation

Although the research design of the current study does not lack rigor, these data must be interpreted with caution. With such a relatively small sample size and the sampling techniques, the findings might not to be validated in a larger population. The sample also may affect the interactions in path analysis. Moreover, the tool used to measure the students' self-regulated learning skills. Some students may have overestimated or down estimated their self-regulated learning skills, which may have influenced the findings.

V. SIGNIFCANCE AND CONCLUSION

This study offers some insight into learning process in online environment; this information can potentially be used as a guide for the future developer of online learning programs to identify the significant factors that may shape their students learning experience and impact the quality of online programs in the region. The study

provided evidence which suggests that structure and interaction are critical factors in online learning and that student beliefs and interactivity can play an important role in their achievement and perception of the e-learning experience. Moreover, it confirms the importance of the quality of online discussion in online learning due to the direct and significant relationship with academic achievement.

Notes on Contributors

Ethical Approval

Funding

Declaration of Interest

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*Enjy Abouzeid
6A Hassan El Bassry Street,
Ismailia, Egypt
Email: Enjyabouzeid@yahoo.com

Appendix A

Table 2 shows the mean responses (± SD) of students and α of each scale of the OSLQ, EQ and the mental model in ILS. [1]

Scale	Number of items	Score (mean ± SD)		α
OSLQ scales (Likert scale 1 to 5)				
Goal setting	5	3.9	± 0.72	0.7
Environment structuring	4	4.2	± 0.74	0.8
Time management	3	3.7	± 0.99	0.8
Help seeking	4	3	± 098	0.7
Task strategies	4	3.6	± 0.80	0.7
Self-evaluation	4	3.4	± 0.88	0.7
e-Learning experience scales (Likert scale 1 to 5)				
Good e-teaching	8	3.9	± 0.75	0.8
Good e-resources	3	3.8	± 0.82	0.9
Student interaction	3	3.3	± 1.0	0.8
Appropriate assessment	3	3.6	± 0.76	0.8
Goals and standards	3	3.9	± 0.89	0.5
Generic skills	6	4.2	± 0.72	0.8
Satisfaction	4	4	± 0.81	0.9
Appropriate workload	3	4	± 0.5	0.9
Mental model of ILS (Likert scale 1 to 5)				
Use of knowledge	5	4.4	± 0.57	0.8
Intake of knowledge	5	3.9	± 0.63	0.8
Cooperation	5	3.3	± 1.0	0.4
Construction of knowledge	5	4.3	± 0.56	0.8
Stimulating education	5	4	± 0.49	0.7

Among the five OSLQ scales, the environment structuring scale had the highest mean (4.2), while generic skills had the highest mean (4.2) among the SCEQ scales. Finally, the use of knowledge scale had the highest mean (4.4) in the mental model (ILS).

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[1] OSLQ: Online Self-Regulated Learning Questionnaire
EQ: e-Learning Experience Questionnaire
ILS: the Inventory of Learning Style

Appendix B

Table 3: shows the effect of the academic achievement on study variables. N=128

Academic achievement	N	Online discussion			
Groups		Mean (SD)	F	df	Sig.
Excellent	56	1.4 (± 0.88)			
Very good	52	1.1 (± 1.03)	3.16	3	0.02
Good	8	1.3 (± 0.82)			
Poor	12	0.5 (± 0.81)			
Academic achievement	N	SRL			
Groups		Mean (SD)	F	df	Sig.
Excellent	56	3.7 (± 0.39)			
Very good	52	3.7 (± 0.53)	1.088	3	0.36
Good	8	3.5 (± 0.36)			
Poor	12	3.6 (± 0.46)			
Academic achievement	N	Conception of learning			
Groups		Mean (SD)	F	df	Sig.
Excellent	56	3.9 (± 0.54)			
Very good	52	4.0 (± 0.48)	0.049	3	0.99
Good	8	4.0 (± 0.42)			
Poor	12	3.96 (± 0.32)			
Academic achievement	N	E-learning experience			
Groups		Mean (SD)	F	df	Sig.
Excellent	56	3.9 (± 0.71)			
Very good	52	4.0 (± 0.57)	4.0	3	0.09
Good	8	4.2 (± 0.53)			
Poor	12	3.3 (± 0.63)			

Appendix C

Table 4: Evaluation of online discussion participation among scoring rubric:

Criteria from the framework		No contribution	Poor	Satisfactory	Good	Excellent
Content	Clarification	33%	30%	27%	10%	1%
	Justification or judgment	33%	26%	30%	9%	2%
	Inference or interpretation	33%	9%	45%	13%	1%
	Application of knowledge (relevance)	33%	23%	30%	13%	1%
	Prioritization of key knowledge	33%	41%	16%	10%	0%
Interaction quality	Critical discussion of contributions	33%	26%	30%	11%	1%
	New ideas/solutions from interactions	33%	46%	20%	2%	0%
	Sharing outside knowledge or expertise	33%	15%	39%	13%	1%
	Use of social cues or emotions to engage with participants	33%	15%	35%	17%	0%
Objective measures	Participation rate	33%	23%	38%	6%	0%
	Consistency of participation	33%	30%	30%	5%	2%