

Characteristics of distance learners: research on relationships of learning motivation, learning strategy, self-efficacy, attribution and learning results

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This research uses adapted self-assessment questionnaires to examine the relationships between the learning motivation, learning strategies, self-efficacy, attribution and learning results of 135 distance learners. The aim is to model the relationship between psychological characteristics and learning results of distance learners. The outcomes of this study show that a relationship exists between psychological characteristics and learning scores of distance learners. First, there is a relationship between self-efficacy, learning strategies and learning results; second, there is a relationship between self-efficacy, internal attribution, learning motivation and learning results. Learning motivation and learning strategies are clearly associated with positive and predictable effects on learning results. The effect values are 0.76 and 0.63, respectively. Self-efficacy and internal attribution have indirectly positive predictable effects on learning results. The effect values are 0.48 and 0.21, respectively.

Keywords: attribution; characteristics of distance learners; learning motivation; learning results; learning strategies; self-efficacy

Raising questions

There is considerable interest from both open universities and traditional colleges in conducting research into online education. Much of this work is research on the characteristics of adult distance learners to identify ways of improving instructional design. An example of this comes from China Central Radio and TV University, where researchers explored the characteristics of distance learners as part of a research project by looking at five aspects of learners: general characteristics, cognitive structure, learning motivation, initial ability and learning expectation. Hong Kong Open University researched the following (May et al., 1999):

- individual characteristics (learning motivation, learning style, cognitive processes);
- organizational characteristics (learning habits such as when and where students choose to learn, how long every week they spend on learning and how to organize learning materials of the course, etc.); and
- task factors (work, society and family duties, etc.).

The literature shows a variety of research strategies to investigate important factors in the design of web-based learning. Boyd (2004) reviews the characteristics of successful online distance learners by investigating successful learners in online courses. This included consideration of techniques, the learning environment, and features of personality and learning. Qureshi, Morton, and Antosz (2002) used a questionnaire survey to identify important characteristics of

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distance learning. They identified demography, motivation, experiences, obstacles, and the environment of distance learners as significant factors. Elsewhere, Halsne and Gatta (2002) adopted the *Mental Measurements Yearbook* (Impara and Plake, 1998) and Barsch's (1996) *Learning Style Inventory* to summarize the characteristics of distance learners. From this they identified demography, occupation and occupational status, educational background, time available per week, learning style and choice of courses as important variables. We can conclude from the above that research into psychological and behavioural characteristics of web-based learners is very varied and lacks a consistent approach. When compared with traditional face to face learning distance learning differs in the way that teachers are separated by time and space. Online distance learners need to manage their learning much more and in this way they are often required to be more self-directed and to monitor their own thinking and action as they work towards the objectives of the course. Zimmerman (2002) suggests that learning motivation, learning strategy, self-efficacy and attribution for success and failure are all important psychological variables in this kind of learning. Ying WANG et al. (2006) suggest that important psychological characteristics of distance learners include learning motivation, self-efficacy, attributions, and learning strategy. Aside from these psychological characteristics, the literature shows an interest in learning results as the focus for analysis. Oxford et al. (1993) identified motivation as the key variable in a study of Japanese-language students using satellite television (Zhang & Sun, 2003).

Romainville (1994) and Bessant (1997) found that successful students are more aware of the learning strategies and procedures they use. They also found a significant correlation between learning strategy and learning results. Jegede and Fan (1999) found that the extent to which distance learners used a cognitive strategy was strongly connected to their meta-cognition. Despite this, it was not possible to determine whether learners with high marks use cognitive strategies more effectively than those with low scores.

Romainville (1994) discovered that high learning scores are correlated with online learners who actively use meta-cognition in their cognitive process. Chen (2004) researched the relationship between learning strategy and the learning results of distance learners at the Network Education College of Renmin University of China. The study discovered that the individual results of learners have a strong correlation with the learning strategy adopted. Elsewhere, many other scholars have identified that high-scoring students are able to obtain help in effective ways (Daubman & Lehman, 1993; Grayson, Clarke, & Miller, 1995; Karabenick & Knapp, 1991; Newman & Schwager, 1995; Ryan & Hicks, 1997).

Zhang and Sun (2003) suggest that learners able to manage their own learning are closely connected with those having good computer skills. Joo, Bong, and Choi (2000) emphasize learners' computer self-efficacy as an important factor in determining network learning results. Jegede and Fan (1999) carried out comparative research on attributes of distance learners and divided students into a high-mark group and a low-mark group. They discovered that learners with the need for high-marks will show more self-reliance and that this attribute is related to improved learning results, while Schunk (1989) found that some learners had an adjustment system that helped modify their potential individual achievement and self-efficacy.

Present research indicates that learning motivation and having a learning strategy are important aspects of self-management for learners and that they have a significant effect on learning results. As two important characteristics of distance learners, how do these two components affect learning results? How are they related? How do the other relevant factors such as self-efficacy and attribution affect learning results? What are the relationships among these psychological variables? Exploring these questions will enable us to identify some psychological characteristics of adult distance learners, to modify instructional strategy and to improve support in distance instruction. It may also help to develop the motivation of learners and change their learning

strategy. The overall impact of such research may also enhance their learning ability to further improve their learning results.

Research methods

Research hypothesis

According to the theory of self-regulated learning and present research, learning motivation and learning strategy have direct effects on learning results. Self-efficacy and attribution also usually affect learning results positively and are connected to motivation and learning strategy. Learners with high self-efficacy are more confident and have higher learning objectives. This often means that learners participate more actively in learning and use certain learning strategies to achieve their objectives. This, in turn, may produce positive effects on learning results. Attribution is a learner's explanation and cognition of their learning behaviour, and this explanation has a close correlation with motivation (Tang, 2003), as well as upon the learner's self-efficacy: 'If failure is attributed to endeavour without effects, self-efficacy and confidence on success will be lowered'. So it can be hypothesized that if a distance learner attributes the failure or success of learning to internal factors such as endeavour or competence then it may be possible to use this to modify their learning motivation, their confidence and their concept of distance learning. This can also be a vehicle for improving their self-efficacy further. Therefore, on the relationship between psychological characteristics and learning results of distance learners, this research makes the following hypotheses:

- Hypothesis one: Learning motivation and learning strategy have directly positive predictable effects on learning results, respectively.
- Hypothesis two: Self-efficacy and attribution have indirect effects on learning results and they can affect learning results via their effect on learning strategy and learning motivation.

Samples

For this research, 135 adult distance learners were sampled (68 females and 67 males). These students were all majors in software development and the application of electronic information technology. The students were all based at Beijing Radio and Television University, and they each received a questionnaire and participated in an instructional experiment.

Research tools

Questionnaire on learning motivation of distance learners. A questionnaire was designed by Wang *et al.* (2006) based on Ausubel's theory of learning motivation, which aimed to measure the tendency and intensity of motivation among distance learners. The questionnaire included three dimensions of intrinsic motivation: cognitive, self-improvement and affiliated. Cognitive intrinsic motivation relates to interest in learning and enhancing one's professional competences and one's own theoretical level. This means the reasons for learners' participation in distance learning are based on their own desire for and interest in learning, and that they want to consistently enrich themselves by acquiring and updating knowledge. Self-improvement refers to the reason for learners' participation in distance learning. It is based upon their consideration of individual professional development and their need to gain a certain position corresponding to their competences or working capabilities. Affiliated intrinsic motivation refers to a learner's need to appear to do a good job in order to keep the approval or acceptance of seniors like parents, teachers, employers, etc. This means that the reason for learners'

participation in distance learning is said to be to obey or satisfy external requirements or expectations.

The questionnaire consists of 34 questions with a four-point Likert scale, with 4 being 'strongly agree', 3 being 'agree', 2 being 'disagree' and 1 being 'strongly disagree'. The mean of the 34 questions is taken as the final score for the questionnaire. The higher the score, the stronger the learner's motivation on this measure. The Cronbach α coefficient of the questionnaire is 0.877. The wording of this questionnaire (four-point scales) is different from the other research tools used because we deleted some neutral options to take account of a possible neutral tendency of motivation.

Questionnaire on self-efficacy of distance learners. This questionnaire was designed by Peng *et al.* (2006) for measuring distance learners' judgement on their completion of distance learning and specific learning tasks in the process of distance learning. The questionnaire consisted of two dimensions, which are general efficiency and special efficiency in distance learning. General efficiency in distance learning refers to the learner's judgement on his or her general competence in successful completion of learning tasks in distance learning. Special efficiency of distance learning refers to the learner's judgement on his or her competence in successful completion of different kinds of learning tasks in distance learning. The questionnaire consisted of 36 questions with a five-point Likert scale, with 5 being 'agree', 4 being 'basically agree', 3 being 'neutral', 2 being 'basically disagree' and 1 being 'disagree'. The mean of 36 questions is the final score for the questionnaire. The higher the score, the stronger the distance learner's efficiency. The Cronbach α coefficient of the questionnaire is 0.928. Questionnaire items include 'I can use the links provided by my teacher to find learning materials' or 'I can't take part in the discussions in the BBS of courses'.

Questionnaire on learning strategy of distance learners. This questionnaire was designed by Wang *et al.* (2007) for measuring the extent to which a learning strategy was adopted in the distance learning process. The questions used the Learning and Study Strategies Inventory (LASSI) scale designed by Weinstein (1990). This is widely adopted domestically and internationally for research. This was modified to focus on distance learning and involved six major indicators:

- Study aids.
- Information processing.
- Time and task management.
- Reflection and summarization.
- Cooperation and communication.
- Examination strategy and emotion release.

There were 53 questions in the questionnaire and a five-point Likert Scale was used, with 1 being 'strongly disagree', 2 being 'basically disagree', 3 being 'neutral', 4 being 'basically agree' and 5 being 'strongly agree'. The mean of 36 questions results in the final score for the questionnaire. The higher the score, the higher the distance learner's learning strategy level and the stronger his or her learning competence will be on this measure. The Cronbach α coefficient of the questionnaire is 0.902. The items of questionnaire are as following, for example, 'I draw pictures or diagrams to summarize materials in the course' or 'I always try to relate my study to my work'.

Attribution of distance learners. We used the section of schoolwork accomplishment in the Multidimensional–Multiattributitional Causality Scale (MMCS) (Lefcourt, Von Baeyer, Ware, &

Cox, 1979) as a research tool. The MMCS mainly measures learner's attribution tendency of the success or failure of schoolwork achievement. This scale puts forward four possible attributions, which are ability and effort, reflecting internal locus of control, and luck and task difficulty, reflecting external locus of control. Each attribution tendency is divided further into two conditions, success and failure. MMCS scale uses a five-point score calculation. The options are 0–4 scores, with 4 being 'strongly agree', 3 being 'agree', 2 being 'neutral', 1 being 'disagree' and 0 being 'strongly disagree'. The scale consists of 24 questions in four dimensions, with six questions in each dimension. In the scale, 12 questions are about the attribution of learning success, while the other 12 questions are about that of learning failure. The mean score of six questions in each dimension is the final score for each dimension. The higher the score, the higher the tendency of the distance learner to attribute success or failure to certain reasons. The Cronbach α coefficient of the scale is between 0.58 and 0.80. The Cronbach α coefficient of the questionnaire is 0.902. Examples of the items on the questionnaire are 'Sometimes a high score in my exam depends on luck' or 'The high marks I received can be attributed to my competence'.

Learning results. The learning results consist of two parts: the learner's end of semester examination scores, and their self-assessment. The average score of the learner's examination results on all courses taken in this semester is considered as the end of semester examination score of the course. The courses includes, among other topics, the Introduction to Xiaoping Deng's Theory, Common Software for Electronic Design, Modern Communication Technology, Electronic Scale and Apparatus, the Theory and Application of Sensors, English, Delphi Programmer, Technical English for Computers, NET Programmer Basic, and Dynamic Webpage Programmer.

Self-assessment aims at allowing the learner to summarize their learning from the courses for that semester. This included nine aspects:

- the degree of interest in major knowledge learned;
- thinking about questions;
- competence in analysing and solving relevant practical problems;
- competence in discussion and communication with others;
- initiative in acquiring information;
- competence in independent learning;
- understanding and memorization of essential theory in the subject;
- basic skills in the subject; and
- mastery through a comprehensive study of knowledge.

The learners are required to assess themselves according to these nine aspects. Grades of assessment are 1–4, with 1 being 'extremely little', 2 being 'comparatively a little', 3 being 'comparatively great' and 4 being 'extremely great'. The mean of the nine scores is the score for the learner's self-assessment. The higher the score, the more the learner will consider they have learned in the course this semester.

Research outcomes

Analysis of descriptive statistics of learner's learning motivation, learning self-efficacy, learning strategy, attribution and learning results

Descriptive statistics of learning motivation, self-efficacy, learning strategy, attribution and learning results are presented in Table 1.

Table 1. Descriptive statistics of learning motivation, self-efficacy, learning strategy, attribution and learning results.

	Mean	Standard deviation	Number of people
Learning motivation	2.92	0.48	135
Self-efficacy in distance learning	3.85	0.53	135
Learning strategy	3.58	0.45	135
Attribution			
Competence	3.24	0.63	135
Endeavour	3.91	0.51	135
Background	2.54	0.71	135
Luck	2.73	0.79	135
Learning results			
End of semester examination score	74.52	9.90	135
Self-assessment	2.93	0.43	135

Analysis of each psychological characteristic and learning results

Correlative matrix of each psychological characteristic and learning result is presented in Table 2.

Model of relationship between psychological characteristics and learning results of distance learners

Taking learning results as a dependent variable and various psychological characteristics as predictable variables, we used AMOS software to set up the structure equation model of the relationship between psychological characteristics and learning results. In the modelling process, we determine that, if four attributions (competence, endeavour, background and luck) are brought into the model independently, the fit of the coefficients is not good. If we combine the scores of four attributions to gain the scores for internal attribution (competence and endeavour) and external attribution (background and luck), we find that internal attribution can be brought into the model and a good model can be established. Finally, the model of the relationship between learners' psychological characteristics and learning results is set up in Figure 1. The analysis indicates that the model is a good fit and the coefficient of each path is significant. The edge of the path from the learning results towards the final examination result of the course is marginally significant ($p < 0.08$) and the other path coefficients are statistically significant ($p < 0.01$).

We can use Figure 1 to illustrate the following example. A learner with high self-efficacy should use some learning strategies to help their study to gain better learning results. In contrast, a learner with low self-efficacy will not get better learning results because they have no confidence in online learning and do not adopt learning strategies in their study.

The fit coefficient of the model is presented in Table 3. The fit coefficient shows that the fit coefficient of the model is good.

From the structure equation model, we find that learning strategy and learning motivation are factors that directly affect learning results. Self-efficacy and attribution affect learning results indirectly. The relationship model provides two paths for affecting learning results:

- Self-efficacy–learning strategies–learning results, which indicates that self-efficacy affects learning results via learning strategy.
- Self-efficacy–internal attribution–learning motivation–learning results, which indicates that self-efficacy affects learning motivation via attribution and ultimately affects learning results.

Table 2. Correlative matrix of each psychological characteristic and learning result.

	Self-efficacy	Learning strategy	Competence	Endeavour	Background	Luck	End of semester examination score	Self-assessment
Learning motivation	0.108	0.164	0.318**	0.103	0.201*	0.275**	0.157	0.419**
Self-efficacy	-	0.677**	0.135	0.255**	-0.145	-0.145	0.053	0.268**
Learning strategy	-	-	0.075	0.060	-0.285**	-0.222**	0.085	0.377**
Competence	-	-	-	0.374**	0.457**	0.463**	0.168	0.288**
Endeavour	-	-	-	-	0.150	0.100	0.035	0.135
Background	-	-	-	-	-	0.699**	-0.001	-0.026
Luck	-	-	-	-	-	-	-0.068	0.073
End of semester examination score	-	-	-	-	-	-	-	0.088

Note: ** $p < 0.01$, * $p < 0.05$.

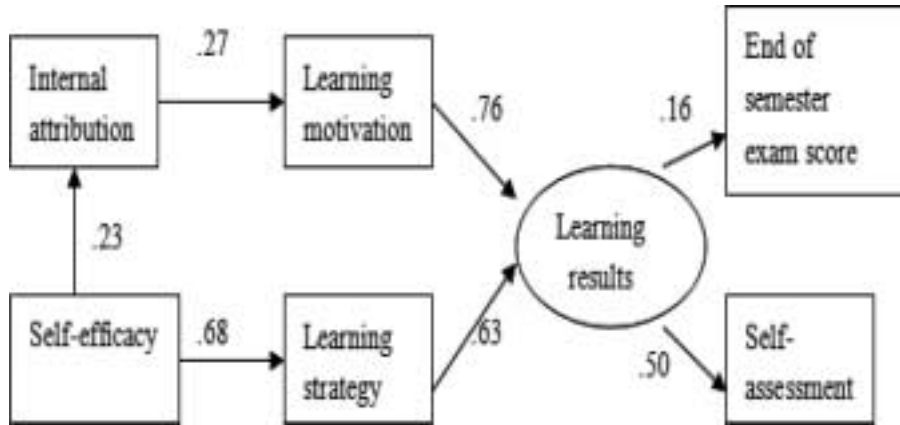


Figure 1. Model of the relationship between learning motivation, self-efficacy, attribution, learning strategy and learning results.

Research outcomes show that learning strategy and learning motivation have positive predictive effects on learning results, with effect values of 0.63 and 0.76, respectively. This means that the higher the learning strategy level, the higher the learning score will be; and the higher the learning motivation level, the higher the learning results. Likewise, self-efficacy and internal attribution have positive indirect effects on learning results with effect values of 0.48 ($0.68 \times 0.63 + 0.23 \times 0.27 \times 0.76$) and 0.21 (0.27×0.76), respectively. This means that the higher the learner’s self-efficacy, the more the success or failure of learning will be attributed to internal attribution and the better his or her learning result.

Discussion

Effects of distance learners’ psychological characteristics on learning results

This research uses data analysis to establish that learning motivation and learning strategy have an effect on distance learners’ learning results. These results not only validate the outcomes measured by Wang and Liu (2000) showing that motivation, having a learning strategy and intelligence levels all have effects on learners’ learning results, but also reflect the idea put forward by Chen and Liu (1998) that learning is affected by various factors, of which motivation is the dominant one. However, this research extends analysis of this idea and brings in the variable of distance learning strategy. It is understandable that in the distance learning process, the utilization of learning strategies will affect learning (whether it is information processing or the management of time and task, the management of emotion and volition, etc.). So, the introduction of the new factor also reflects the importance of learning strategy in the distance learning process. In summary, learning results are mainly affected by learning strategy. This is particularly so in self-directed learning and collaborative learning for distance learners, where having a

Table 3. Fit coefficient of model structure.

Fit coefficient						
χ^2	<i>P</i>	$\chi^2/\text{degrees of freedom}$	Normed fit index	Incremental fit index	Tucker-Lewis index	Root mean square error of approximation
8.316	0.403	1.039	0.946	0.998	0.994	0.017

learning strategy plays an important role. This conclusion is similar to the research outcome from Shih and Gamon (2001), which also supports the view that the level of learning strategy is one of the most important factors in determining learning results. Also, it is similar to the research outcome from Liu, Xi, Huang, and Shen (2000), which indicates that learning motivation can indirectly affect learning results because of learning strategy.

This research finds that distance learner's self-efficacy has no direct effect on learning results but there may be an indirect effect. By this we mean that it is difficult to use learning strategy to improve learning scores. The extent of the distance learner's self-confidence in their ability to participate in distance learning, and their view of their own skills related to distance learning, affects the level of learning strategy, which further affects the learner's result.

In the field of distance education, there is little research on the psychological factors of learners and even less on attribution. This research finds that internal attribution (including ability or effort) affects learners' results indirectly via learning motivation. In the research on attribution, we discovered that the success or failure of the distance learner is usually due to effort. This is an unstable factor with an internal locus of control. In second place is competence, which is a stable factor with an external locus of control. Learners can gain increased motivation by increased effort or by developing certain competencies to further affect learning results. Internal attribution containing competence and endeavour enhances learners' confidence in learning. This enhances the learner's confidence in being able to complete distance learning tasks and indirectly affects learning results.

Implications of the research for teaching and learning support

The model of distance learners' psychological characteristics set-up in this research indicates the following recommendations for practical teaching. It may particularly help to improve learning support.

First, it is important to help learners adapt to self-directed learning in a distance environment. As a mature individual, the distance learner shifts from being a dependent type to an independent type. The transforming process will occur for different people at a different pace and within different lifestyles. Teachers have the responsibility for encouraging and supporting this transformation. This can be done by helping learners overcome difficulties and adapt to self-directed learning in a distance environment and particularly for learning in a web-based environment.

Second, it is important to pay attention to and strengthen instruction related to learning methods for distance learners. As the research outcomes show, learning strategy has a direct impact on learning results. Teachers should pay attention to learners' learning strategy. They should provide appropriate training about learning strategy to develop the learner's consciousness of different strategies. They should also design a handbook for 'Guidance on Distance Learning Strategy' based on the questions in the present questionnaire on strategy, and provide specific learning methods in the hope of improving results. Teachers wanting to analyse the strategy characteristics of distance learners can get feedback by asking learners to fill in the questionnaire of strategy characteristics. This will help identify the characteristics of learners so that appropriate support can be provided. For example, the results of the learning strategy survey can be given back to the learners to help make them aware of their learning strategy in particular situations. This might be developed further by providing some books or web sites that introduce remedial or developmental exercises, learning methods and techniques based on this knowledge. It may even be worth offering lectures on these issues. In addition, teachers can further analyse which strategy is currently weakest among the collection of learning strategies held by these learners. This may include their strategies for study aids, information processing, reflection and summarization,

examinations, emotion and volition management, cooperation and communication, and time and task management. If the strategies for either emotion release or cooperation and communication are weak, then learning support services should be provided to engage these learners in distance learning as much as possible through conversations, homework feedback, the design of group learning activities, and so forth. These needs arise largely from the separation of tutors and learners as an attribute of distance learning.

It is also important to specify learning objectives, and to help with improving and promoting the level of the learner's learning strategy. Learning objectives are the starting point and the final goal of learning strategy, and determine the learning activity. The essence of learning strategy is the effective supervision, adjustment and control of the learning process. Learners need to compare their draft plan with their achievement of the objectives. This provides feedback to enable them to adjust their learning processes accordingly. The outcome of this process may result in them directing their attentions elsewhere or changing their learning methods. It may also cause them to revise their learning objectives. The diversity of learning objectives will directly affect the form of learning strategy. In summary, having a learning strategy is an advanced skill that may help improve the effectiveness and success of the learner. The active learner analyses a specific question according to the changes of internal and external environments in order to adjust and control their psychology, their learning methods and their learning skills.

Third, there is a need to emphasize the self-efficacy and to correct the attribution of learners, first of all by reinforcing the cultivation of self-efficacy. The research finds that, as an adjusting variable, self-efficacy brings about a reaction with the potential to cause the improvement of both learners' learning methods (especially those including the component of self-adjustment) and learners' expectation of the results. Self-efficacy can determine subsequent behaviour, but it is also affected by the results of previous behaviour. The result of negative behaviour over a long time will lead to the decline of learners' learning efficacy. Distance education institutions may help learners to enhance their self-efficacy by allowing them to acquire successful experiences or by allowing them to observe the learning behaviour of others having substantial experience. This can strengthen their own understanding and further promote the development of learning strategy. Attention should be paid to cultivating the ability of learners to give reasonable self-reflection and attributive explanations of their experiences of success and failure. The survey on the attribution of learning success and failure reflects the collective tendency of learners' attribution. Learning support services, in distance educational institutions, need to deliver appropriate instruction so as to enable learners to make a correct attribution of their learning results and avoid incorrect attribution.

Finally, there is a need to inspire learners' learning motivation. The research outcomes show that distance learners have diverse levels of motivation and that learning motivation has a direct impact on learners' results. Therefore, distance education institutions need to recognize that learners do have different learning motivations and avoid support for one-sided cognition. Support services need to recognize that intrinsic motivation is more important than extrinsic motivation. Attention needs to be given to understanding the learning environments in which learners are studying and to create conditions according to the intrinsic motivation of the learner. This will enhance learners' overall motivation through allowing every learner to gain some experience of success and through providing learners with more opportunities to develop a sense of being successful; for instance, opportunities for the recognition of success can be created through the selection of learning contents that combine easy and difficult activities. The same can be done for the completion of homework, participation in learning activities, testing of units and the pacing and timing of learning opportunities. This could enhance motivation and improve results for learners.

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