The Role of Behaviourist Theory in Educational Technology

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Abstract

Educators from behaviourist theory's perspective can shape the behaviour and responses of learners to a specific stimulus in order to help them acquire new knowledge.. Research has been performed, previously, into how students learn and gain information, and how to encourage it. Most of the research fixated on the tutors acting as the organisers. Very little research has been executed concerning students acting as the organisers. Therefore, this study was intended to review the role of behaviourist theory in educational technology

The purpose of this piece of work is to demonstrate the central features of behaviourist theory and discuss the extent to which this theory can be said to have inspired the design of

educational technology. This paper provides a historical summary of the behaviourist theory, explains the theory's main features, and describes how the theory was applied in practice with giving examples in which to explain how to activate it in the educational context. Finally, the paper presents an example of educational technology through the Propagate platform, the design of which is based on behaviourist theory, and which is used in education to emphasise and facilitate teaching and learning.

Keywords: Behaviourist Theory- Educational Technology- classical conditioning- operant conditioning

دور النظرية السلوكية في تكنولوجيا التعليم

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الملخص

يمكن للمعلمين من منظور النظرية السلوكية تشكيل سلوك واستجابات المتعلمين لمحفز معين من أجل مساعدتهم على اكتساب معرفة جديدة. وقد تم إجراء الأبحاث سابقاً حول كيفية تعلم الطلاب واكتسابهم للمعلومات، وكيفية تشجيعها. ركزت

معظم الأبحاث على قيام المعلمين بدور المنظمين. وتم إجراء القليل جدًا من الأبحاث فيما يتعلق بالطلاب الذين يقومون بدور المنظمين. ولذلك جاءت هذه الدراسة لاستعراض دور النظرية السلوكية في تكنولوجيا التعليم. ويكمن الغرض من هذه الورقة البحثية في إظهار السمات المركزية للنظرية السلوكية ومناقشة إلى أي مدى يمكن القول أن هذه النظرية قد ألهمت تصميم تكنولوجيا التعليم ليتلاءم مع أنماط تعلم المتعلمين. بالإضافة إلى أن هذه الورقة البحثية تقدم ملخصا تاريخيا للنظرية السلوكية، ويشرح الملامح الرئيسية للنظرية، ويصف كيفية تطبيق النظرية عمليا مع إعطاء أمثلة لتوضيح كيفية تفعيلها في السياق التعليمي. وأخيرا، تعرض الورقة نموذجا لتكنولوجيا التعليم من خلال منصة Propagate، التي يعتمد تصميمها على النظرية السلوكية، والتي تستخدم في التعليم للتأكيد على عملية التدريس والتعلم وتسهيلها.

الكلمات المفتاحية: النظرية السلوكية – تكنولوجيا التعليم – الإشراط الكلاسيكي – الإشراط الإجرائي

1. Introduction

Education plays an important part in people's lives, as it helps them communicate easily with each other. As a consequence, people who are concerned about education always strive to develop better ways of learning. 20th century researchers - Pavlov, Watson, Thorndike and Skinner in particular - developed the behaviourist theory as a means of facilitating ways for people to gain particular behaviours and learn new patterns, as well as proposing effective ways of influencing and changing behaviour (Staats, 1996). As indicated

by Ally (2011), learning occurs through interaction with stimuli in the surrounding environment. It seems, therefore, that the behaviourist theory will help enhance ways of learning. Ally (2011) also asserted that the use of technology in educational settings can enable students to grasp information more effectively. Technology can also be viewed as a stimulus by which to engage students in the learning process. As a result, certain aspects of educational technology have been developed using the principles of behaviourist theory to help students acquire new skills. However, even though the behaviourist theory played a crucial part in enhancing the learning process, it is now considered outmoded. It has moved from being the most influential theory in education in the 1950s and 1960s to perhaps among the least influential today (Tompkins, 2014).

The purpose of this paper is to demonstrate the central features of behaviourist theory and discuss the extent to which this theory can be said to have inspired the design of educational technology. This paper provides a historical summary of the behaviourist theory, explains the theory's main features, and describes how the theory was applied in practice. Finally, the paper presents an example of educational technology through

the Propagate platform, the design of which is based on behaviourist theory, and which is used in education to emphasise and facilitate teaching and learning.

2. Behaviourist theory definition

Behaviourist theory can be regarded as a means of measuring observable behaviours that occur in individuals in response to stimuli in the environment (O'Donohue and Kitchener, 1999). The responses to stimuli can be reinforced by positive and negative feedback, which will in turn condition the desired behaviours (ibid.). According to this definition of behaviourist theory, it can be seen that educators can shape the behaviour and responses of learners to a specific stimulus in order to help them acquire new knowledge.

John B. Watson, an American psychologist, frequently referred to as the father of early behaviourism, began to develop behavioural theories in 1913 (Owen, 2002). According to Watson, psychology should focus solely on studying behaviour, and should not be concerned with the study of the human mind and consciousness (Owen, 2002). As one cannot verify the concepts of consciousness and introspection, these conceptual processes should not be included in any psychological study.

Thus, in the positivist theory, it is believed that the only established knowledge is that which can be proven; similarly, people's behaviour can be studied since it can be perceived by all human beings. In short, behaviourism was the resultant outcome of positivism and mechanism (O'Donohue and Kitchener, 1999).

In line with this analysis, one can clearly argue that behaviourism is more inclined towards the study of behaviour than the process of thought, feeling or knowledge. The focus of behaviourism is thus on the goal and observable mechanisms of behaviour. According to the behaviourist theory, human behaviour lies in a number of practices and habits acquired by the person throughout the various phases of their development (Graham, 2015). For that reason, it can be said that stimulus-response instruments contribute to the learning process.

3. Behaviourist theory features

Behaviourist theory plays a vital role in the educational context. Its principles have been used to guide educational practice, and its central features have shaped the way of teaching and inspired the design of educational technology tools. Some fundamental features are described in the following

section.

3.1 Association (classical conditioning and operant conditioning)

There are two types of conditioning associated with learning behaviour: classical conditioning and operant conditioning. Classical conditioning, associated with Pavlov, entails acquiring a new behaviour through the process of conditioned association and the reactions thought to be stimulated (Owen, 2002). Pavlov confirmed that the learning process could be used to establish a link between stimuli in the environment and stimuli that are naturally occurring (Staats, 1996). Furthermore, learning takes place when the association between unconditional stimuli with neutral stimuli is repeated; the neutral stimuli will produce a similar effect to the unconditional stimuli and thus, produce a similar reaction (Staats, 1996).

Operant conditioning is also known as Skinnerian conditioning, named after the leading psychologist who developed the theory. Skinner's view was that learning can be achieved through stimuli, and stated that the effect of reinforcement is to consolidate the rapport between the stimuli

and the response (Owen, 2002). In addition, according to Graham (2015), both Thorndike and Skinner were in agreement that the learned behaviour is more likely to be repeated if the learners were satisfied with the results of this behaviour. As stated by Staats (1996), the majority of Skinner's tests were carried out in an instrument known as the 'Skinner box', which contains devices for reward, including food and water. The box also has sources of excitement such as lights and a speaker.

In an experiment involving a rat (see Figure 1), the rat can get food as a reinforcement by pressing down on a bar. In this experiment, it appears that responses in the operant conditioning are emitted and the rats are reacting to situations in the environment rather than taking a key part in exploring this environment (Staats,1996). In addition, it appears from this experiment that, to achieve a particular behavior successive steps of the behavior are rewarded until the learners acquire the
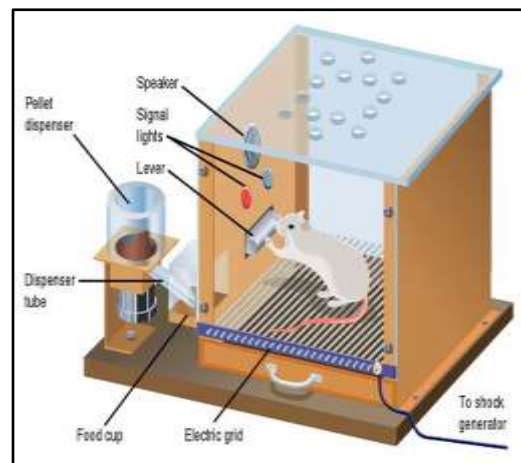
Figure 1: Skinner experiment on a rat (Mcleod,2015)   (Mcleod,2015)

particular behavior. Therefore, it is clearly the role of the association between the stimuli and the reinforcement in encouraging the behavior. Consequently, educators can use this method of reinforcement in order to encourage students to learn. For example, primary school teachers can motivate their pupils to read by giving them a reading book and a card to be signed by parents each time their child reads the book. When the child brings the completed card to the teacher, they will be given a present as a reward for finishing the book.

3.2 Behaviour shaping strategy

A significant experiment carried out by Skinner included training pigeons to develop certain responses, including lifting their heads, and then using this habit to help them learn more complex behaviours, such as playing table tennis to pass the ball back and forth across the table (Brown and Jenkins, 1968).

By looking to Figure (2), it can be seen that to teach the pigeon to raise its head, Skinner put a pigeon in a cage with lines marked on the walls, so that he could measure how high the

Figure 2: Skinner experiment on pigeons (Brady, 2014) (Brady, 2014)

pigeon's head rose in normal circumstances and how high it rose on less frequent occasions. Whenever the pigeon's head reached the higher line, food would be provided; this process was repeated so that the pigeon learned to lift its head higher and gain the reward. Once this behaviour had been learned, the pigeon's head rarely fell below the specified level. Accordingly, it seemed that the food acted as a reinforcement to encourage the pigeon to raise its head. As a consequence, teachers can benefit from the advantages of this strategy to encourage students to learn by using a rewards for students who participate in class.

Skinner's experiment shows the importance of direct reinforcement for each successful movement carried out by the animal, with the ultimate aim of acquiring a pattern of behaviour and altering the behaviour as necessary in order to shape a specific behaviour. Tolman (1938) clarified that the notion of shaping is considered to be a strategy by which a learner can acquire new knowledge or new behaviour. Thus, immediate reinforcement after a student's response is a worthwhile technique in teaching: positive reinforcement rewarding the correct answer or negative reinforcement as a

reaction to the wrong answer.

Overall, it seems that behaviourist theory has been constructed through the meticulous investigation of an object's response and behaviour in a research laboratory, as well as through analysing the association between behaviour and environmental determinants in particular situations. There is no reaction without stimuli; if these stimuli are repeated, the associated response will also be repeated (Owen, 2002). For example, a child learns a language by associating linguistic words with things that represent these linguistic words.

4. Behaviourist theory in practice

Skinner's theory not only worked in theory, but was also put into practical use, leading to a number of solutions for various learning and teaching issues. It has been proved possible to enhance learning outcomes by taking into account the features of behaviourist theory, including immediate reinforcement after a student's response. This can be achieved by dividing the lesson into a number of discrete elements for each objective and by offering evaluation and reinforcement for each objective immediately after studying it. The principle of feedback should be used to reform the educational system

gradually, while paying attention to the issue of individual differences.

One can also infer that Skinner's theory had a significant effect on education as it contributed to the emergence of programmed instruction, which is a method of self-education. As confirmed by Ally (2011), using this method involves dividing the learning material into small steps to be undertaken by the learner, who would attain the reinforcement after each step to ensure that progress is effective. The early manifestations of this method can be traced to Sydney Bryce, who developed the first machine for education in the 1920s, but it was not until Skinner's influential lecture on teaching and learning at a psychology conference in the USA that there was any real interest in educational programs (Owen, 2002). However, the idea of programmed instruction is based on Skinner's operant conditioning theory, and followed from the well-known experiment involving the pigeon, which illustrates the significance of immediate positive reinforcement after correct responses until the learning process is complete and the unwanted responses gradually disappear as they receive no positive reinforcement.

Current instructional design practices include a number of the basic assumptions and features of behaviourism. In fact, the concept of behaviourism was adopted as a benchmark for planning several early audio-visual materials while paving the way for many relevant teaching approaches, including Skinner's teaching machines and programmed texts, as well as later examples such as the principles adopted in computer-assisted instruction (CAI) and mastery learning, which is an educational strategy that aims to ensure that students achieved the level of mastery in given knowledge before resuming to grasp subsequent information (Mergel, 1998). To leave a lasting impression on students, learning should be made a positive and successful experience; students should be encouraged to delve into learning contexts and move forward on the learning curve, and should be helped to acquire new concepts. The learning process should also support students to grow in ways that may give them instant empowerment, both within and outside their educational environment.

5. An example of educational technology that reflects behaviourist theory

The overall objective of behaviourist theory is to establish new behaviours in learners. The Propagate platform appears to

help students learn successfully and influence their academic behaviour through behaviourist techniques. Propagate can also be seen as a successful investment for achieving the outcomes of teaching by aiming for more learning with less sources. It was developed at the Harvard Graduate School of Education and is the result of research. Some of its basic principles stem from behaviourist theory and can be used by designers of educational materials, including learning by small steps, reasonable progress, tasks, instant feedback and students' capability.

Propagate can be used to support teachers and educators to enhance the learning outcomes of their students in both the short term and the long term. It was designed for all teachers, regardless of specialisation or the education level at which they are teaching, whether at school or college. Teachers should notice an improvement in their students once they start reading and practising with Propagate. Some of the activities of the Propagate platform that reflect behaviourist theory principles are given below.

5.1 Create class material in the Propagate platform

Propagate can help educators to create their class material

as well as organise and manage the way in which the information is taught. As such, each teacher can include the stimuli that they need to enable students to develop the appropriate behaviour, similar to the manner in which Skinner taught rats to respond by using food as a stimulus (Staats, 1996).

While managing their classes, the teacher should follow two major principles. The first principle is to follow the small steps strategy, which involves dividing the learning information into very small portions, each of which has to have a reward or reinforcement to incentivise the students and make the learning experience more effective. Dividing the material into small units makes it easy for the student to absorb (Ally, 2011), which can then maximise their chance of the reward and the feeling of success that may lead to further success and achievement.

The second principle in the creation of classes relates to organising the learning material in a progressive sequence, so that it leads to a logical structure in which the content is arranged from the easiest to the most difficult. In addition, the information provided should be centered on the target of that unit, and any irrelevant material should be omitted so as to keep the learners' focus on the core content themes (Tompkins, 2014). However, although this theory appears to enhance the

way of teaching, it ignores the role that inherited and cognitive factors play in learning, which is why some researchers have been anti-behaviourist.

5.2 Quiz and practice activity in the Propagate platform

Another property of Propagate inspired by behaviourist philosophy is test or training activity, which aims simply to ensure that students have understood the knowledge that has been defined and then to provide a suitable reinforcement to their response. According to Brown and Jenkins (1968), positive reinforcement will encourage behaviour to continue, whereas negative reinforcement will eliminate behaviour from recurring. Therefore, when constructing this quiz activity, whether by creating one's own lists or by using existing material on a wide array of subjects, the choice of appropriate reinforcement to students' answers should be taken into consideration. It appears that this feature aims to help educators supervise student progress, as it highlights the areas where students are excelling and where they need more support. Identifying the information that their students find difficult to master will help teachers support them in the classroom. Using Propagate, it is possible to inculcate new knowledge in the most effective manner, i.e., by

repeatedly exposing the students to personally meaningful situations in the same way that Skinner trained a pigeon to play with a ball.

Although some may argue that this instructional strategy only helps students to acquire knowledge for a specific assessment which they then immediately forget, this type of activity can assist learners to better grasp the knowledge because they will receive positive reinforcement from the teacher if the appropriate skill is displayed in the quiz, which will help the knowledge be retained for as long as possible. For example, in English classes, this type of activity can help students understand how to construct complete sentences or how to write words properly in the appropriate context.

5.3 Customised review games in the Propagate platform

The last activity in Propagate platform that stem from the behaviorist theory is customised review games which are created to produce exceptional and adaptive experiences for all learners, stratifying the concept of an individual's learning speed. This enables students to fulfil their potential and ensures that they are not required to do more than they can manage, as indicated by Staats (1996). In addition, it enables students to

review and practice their knowledge in a motivating setting to reinforce engagement, and thus, would be considered a stimulus, motivating the students to learn.

Nevertheless, it is questionable what would happen if this stimulus is not repeated. It seems that students may lose motivation as their enthusiasm toward learning is linked with the presence of this stimulus. As O'Donohue and Kitchener (1999) stated that the exist of acquired behavior depends on the presence of stimuli.

In contrast, this technology is designed to be suitable for all students, and aims to help even those students who struggle the most to manage and succeed in their learning.

6. Conclusion

This paper demonstrated that the behaviourist theory strongly believes that the association between stimulus and response can encourage the desired behaviours in a learner. Therefore, it contributes to designing the instructional technology. Particularly, this paper presented the philosophers of behaviourist theory who stressed the importance of stimuli and reinforcements in shaping new behaviours for a learner. In addition, it provided a definition of this theory and indicated

that this theory includes two main types of learning forms: classical conditioning (Pavlovian), and operant conditioning (Skinnerian). Both forms appear to rely on generating stimuli, although Pavlovian conditioning is based more on association between stimuli and responses, whereas Skinnerian conditioning relies more on reinforcement.

In addition, although behaviourist theory has faded from popularity, many current teaching practices are derived from Skinner's theory. For instance, the Propagate platform has been considered in this paper as an example of an educational technology tool that uses the principles of behaviourist theory in addition to other theories such as constructivism and social culture. It also appears that behaviourist theory has given rise to important concepts used in education today: behavioural objectives, the use of reinforcements, individualised instruction, and the simple-to-complex sequencing of content. In addition, it was the base for building other theories and effectively contributed in their occurrence. In the end, it can be said that the optimal learning environment is constructed by combining all learning theories in order to benefit from the characteristics of each.

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