

# Nudging Learning Behaviour: A Systematic Review

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## ABSTRACT

This review examines nudge intervention in influencing learning behaviours from the context of the information use environment. It was conducted based on PRISMA guidelines. Six major databases were searched, and ten studies were included in this review after screening. Overall, the included studies reported beneficial outcomes in the academic settings, but results were mixed as nudge interventions were context-dependent. To convey course-related information during the nudge intervention, all the included studies used at least one technique from category A-Decision Information and most used a secondary technique to enhance or manipulate the intervention. Among the techniques, A1-Translate Information, A2-Make Information Visible, and C1-Provide Reminders were widely used. However, there was no ideal nudge technique or a combination of nudge techniques that were effective across all situations. Nonetheless, this review underscored the importance of incorporating nudge techniques in an informational learning environment that could shape and motivate learners.

## KEYWORDS

Nudge, intervention, information use environment, systematic literature review, learning behaviour

## INTRODUCTION

Using the information to encourage individuals to change their behaviour in ways that are beneficial to themselves or society without forbidding their freedom of choice has gained significant attention in recent years (Münscher et al., 2016; Thaler & Sunstein, 2008). This approach, termed ‘nudge’, is based on the basic premise that people’s daily decision-making is inherently autonomous or follows perceived norms (Thaler & Sunstein, 2008). Hence, it is not rational due to their own cognitive biases and heuristics (Thaler & Sunstein, 2008). Nudge exploits these cognitive biases and heuristics to influence people’s decision-making towards an intended outcome (Thaler & Sunstein, 2008). In other words, nudge uses the information to design interventions that could subtly change people’s behaviour. Past reviews have investigated nudge intervention in various domains. For example, Sarpy et al. (2021) reviewed the construction safety domain and highlighted nudge techniques were used to enhance how information was presented, how options and decision formats were arranged, and how people followed through with their intentions. Notably, there were indicators in Sarpy et al.’s (2021) findings that aligned with Taylor’s (1991) notion of information use environment (IUE). Specifically, IUE influences workers’ safety and health decisions, and the environment in which the information is operating further influences workers’ decision-making. IUE, a set comprises “*people*, structure and thrust of *problem* of those set of people, typical *settings*, and what constitutes *resolution* of problems” (p. 221), affects the flow and use of information that determines how the value of information will be judged (Taylor, 1991). However, there is limited review to examine the state of nudge research in the educational domain, particularly in learning behaviour. Guided by the IUE, this review will extend current nudge research in learning behaviour by examining the characteristics of past nudge studies (*people*, *problem*, *setting*), usage and nudge techniques (*resolution*), and their extent of effectiveness with considerations of the antecedent factors.

## RESEARCH METHOD

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA; Page et al., 2021) guidelines and guided by the PICO-C (*Population*, *Intervention*, *Comparison*, *Outcomes*, and *Context*) framework to search and select the queried studies for inclusion into this review. The Mixed-Methods Appraisal Tool (MMAT; Hong et al., 2019) was used to assess the quality of the studies and their nudge techniques were categorised according to the taxonomy by Münscher et al. (2016). Six major databases, ERIC, Education Source, PsycINFO, ScienceDirect, Scopus, and Web of Science, were searched for studies published between January 2008 and November 2021 that aligned with the nudge concept developed in 2008. A keyword search strategy (related to nudg\*, behavioural economics, intervent\*, choice architect\*, learn\*, educat\*, and self-regulat\*) was developed to ensure the queries were relevant, optimised, and inclusive of British and American spellings. The queried studies were screened in two stages. First, the studies’ titles, abstracts, and associated metadata, such as types of journals and languages used, were retrieved and reviewed based on the inclusion (published in English language and peer-reviewed journal) and exclusion (grey literature) criteria. In the second stage, the full text was retrieved for further evaluation based on the PICO-C framework before being selected for inclusion in this review. Data were then extracted from the included studies using the ten pre-defined categories for comparison and synthesis. The first author performed the data extraction, and the second author verified the accuracy of the extracted data. Any discrepancies were resolved through discussion and consensus.

## RESULTS

A total of 481 records were retrieved from the six databases. Of which, ten studies were selected in this review after the screening. The ten studies covered diverse areas (*setting and problem*) that included evaluating the effects of self-directed scheduling (Baker et al., 2016), improving cooperative learning (Buchs et al., 2016), enhancing learning experiences and outcomes (Dart & Spratt, 2020), reducing procrastination in a competitive learning environment (Li et al., 2021), informing on imminent submission deadlines (Motz et al., 2021), persuading students to improve their study consistency (O'Connell & Lang, 2018), evaluating the impact on procrastination (Onji & Kikuchi, 2011), improving the enrolment rate of tutoring services (Pugatch & Wilson, 2018), evaluating the impact of learning outcome (Sinha et al., 2021), and improving task performance (Smith et al., 2018). These ten included studies were published between 2011 to 2021 across six different countries. The sample size ranged from 187 to 18,043. Participants were recruited from colleges and universities (*people*). The quality of the studies varied. Five studies fulfilled all the MMAT criteria (Dart & Spratt, 2020; Li et al., 2021; O'Connell & Lang, 2018; Pugatch & Wilson, 2018; Smith et al., 2018). Another four were unable to fulfil the randomisation criteria (MMAT 2.1) in the quantitative RCT category as the studies did not specify how the randomisation schedule were generated (Baker et al., 2016; Buchs et al., 2016; Motz et al., 2021; Sinha et al., 2021), and one did not account for the confounders (MMAT 3.4) in the quantitative non-randomised category (Onji & Kikuchi, 2011).

Based on the Münscher et al. (2016) framework (*resolution*), A1-Translate Information ( $n = 7$ ), A2-Make Information Visible ( $n = 7$ ), and C1-Provide Reminders ( $n = 7$ ) were the most popular nudge techniques. Other techniques identified were, A3-Provide Social Reference Point ( $n = 3$ ), B1-Change Choice Defaults ( $n = 1$ ), B2-Change Option-related Effort ( $n = 1$ ), and C2-Facilitate Commitment ( $n = 1$ ). Most studies combined several techniques in their nudge intervention design. Two studies used four types of techniques, five studies utilised three techniques, and one combined two types of nudge techniques in their nudge designs. Only two studies used the single nudge technique. Nine studies reported positive results in improving students' academic performances, learning outcomes and experiences (Buchs et al., 2016; Dart & Spratt, 2020; Li et al., 2021; Motz et al., 2021; O'Connell & Lang, 2018; Onji & Kikuchi, 2011; Pugatch & Wilson, 2018; Sinha et al., 2021; Smith et al., 2018). However, students' characteristics such as gender and contextual variables in the area of prior academic performances and behaviour (Li et al., 2021), the timing of interventions (O'Connell & Lang, 2018; Onji & Kikuchi, 2011), and the presented information exposed to students (Motz et al., 2021), were factors affecting the degree of nudge effectiveness. Meanwhile, the tenth study reported no effect on near-term engagement and a weak significant negative impact on long-term engagement, persistence, and performance (Baker et al., 2016).

## DISCUSSION AND CONCLUSION

This review presents preliminary findings on nudge research to ascertain the effective use of information to nudge learning behaviour from the IUE perspective. Overall, the included studies showed positive nudge effectiveness but mixed results. This was mainly due to confounding effects arising from nudge dependency on the intervention's context that affects its outcomes. Hence, future nudge research needs to account for any potential factors during nudge design to mitigate and control the confounding effects. Meanwhile, all the included studies used at least one technique from category A-Decision Information. Most would use at least two techniques within or across different nudge techniques' categories in their intervention design. The secondary technique was either used to reinforce or further manipulate the intervention. These findings were not surprising as course-related information was required to trigger learners' System 2 decision-making process in deliberating and reasoning on their next course of actions that entailed consequences on the learning goals. Key to this process is the role of information use underpinning decision-making and learning behaviour. However, nudge effects in the longer term currently remains a limitation. Future research is suggested to focus on examining the interplay between IUE and nudge to overcome the limitation.

The low numbers of included studies were not unexpected, given that nudge is a relatively new field in education (Weijers et al., 2021). This limitation is well acknowledged by organisations such as Joanna Briggs Institute and Cochrane (Slyer, 2016; Yaffe et al., 2012). Nonetheless, the diversity of countries and study designs provided converging evidence on nudge's applicability worldwide. The four studies that lacked the proper randomisation process might raise concerns on the results' validity due to potential biases and random errors during the experimentation (Kendall, 2003). This is especially crucial in the educational context. Given that there is an added responsibility to ensure that nudge interventions applied should not disrupt educational learning nor have negative spillover effects to other essential areas (Weijers et al., 2021). Hence, attention should be given during the study design to achieve higher quality research. In sum, this review examined exiting nudging research landscape from the IUE perspective. IUE influences learners' learning decisions, and the academic environment would further influence their decision-making. Further, nudge could potentially extend to other information domains, such as information seeking to guide information behaviour. More importantly, the review's findings aligned with prior works (e.g., Ma & Lee, 2020) that advocates developing an informational learning environment that motivates learners. Specifically, this review underscores the importance of incorporating nudge in the informational learning environment.

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