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# Investigating the Impact of Differing Levels of Autonomy on Learning and Motivation in a Key Stage 4 Science Class

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## Abstract

*This study investigated the impacts of autonomy-supportive interventions on student learning and motivation within a secondary school context. Employing Self-Determination Theory (SDT), the study aimed to understand how increasing student autonomy through choice in both the quantity and nature of work impacts learning outcomes and engagement. Interventions consisted of an autonomous homework model and an independent revision session. Homework completion rates improved modestly from a pre-intervention average of 84% to 92% during the intervention. Moreover, the quantity of homework completed showed a modest increase, and more students engaged in self-marking their work over time, indicating enhanced self-regulatory skills. The autonomous revision session resulted in mixed student feedback and slightly lower test scores compared to previous ones. However, positive signs of engagement were observed. Further research could focus on the long-term effects, sustainability of such interventions, and teacher perspectives to provide a more comprehensive understanding.*



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# Investigating the Impact of Differing Levels of Autonomy on Learning and Motivation in a Key Stage 4 Science Class

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## Introduction

In today's complex and dynamic educational landscape, teachers and policymakers are constantly seeking effective ways to cultivate student motivation and engagement. One promising approach to address this challenge is through the promotion of student autonomy, which involves providing students with a sense of control over their learning experiences. Grounded in self-determination theory (Deci & Ryan, 1985), autonomy is believed to play a crucial role in enhancing intrinsic motivation, engagement, and academic achievement. This essay seeks to investigate the impact of differing levels of autonomy on learning and motivation in a Key Stage 4 science class, with a focus on how increasing the amount of student choice regarding the nature and quantity of work completed by students can influence these outcomes.

The importance of fostering student autonomy in education has gained increasing attention in recent years, as research has demonstrated the potential benefits of providing students with opportunities to make choices and take ownership of their learning. Such autonomy-supportive environments have been linked to improved student motivation, engagement, and academic performance across various subjects and contexts (Reeve, 2006; Stefanou et al., 2004). However, the optimal level of autonomy and the specific factors that contribute to its effectiveness in promoting learning and motivation remain topics of ongoing debate and investigation.

The Research Question (RQ) guiding this investigation is: "How do varying levels of autonomy, provided through different degrees of choice in the nature and quantity of work completed, affect learning and motivation outcomes in a Key Stage 4 science class?" To address this question, the essay will begin with a comprehensive literature review, discussing autonomy from the perspective of self-determination theory and examining its role in education, particularly in relation to student

choice. The literature review will also explore the potential benefits and challenges associated with implementing autonomy-supportive practices in the classroom.

Subsequently, the essay will present findings from an experimental study conducted with a Year 10 science class in a UK secondary school, where students experienced different levels of autonomy in their learning activities, through the provision of choice in both the nature and quantity of work they were expected to complete. This study aims to provide valuable insights into the practical implications of promoting autonomy in a Key Stage 4 science class and the extent to which varying levels of choice can impact student learning and motivation.

The essay will conclude with a discussion of the study's results, implications for educational practice, and recommendations for future research. In particular, the discussion will address the potential benefits of incorporating autonomy-supportive practices into science education at the Key Stage 4 level, as well as the challenges and limitations associated with implementing such practices. Additionally, the conclusion will offer suggestions for further research to advance our understanding of the role of autonomy in promoting student engagement and achievement in science education and beyond.

## Literature Review

Self-Determination Theory (SDT) is a psychological framework that focuses on understanding human motivation, development, and well-being. Developed by Edward Deci and Richard Ryan in the late 20th century, SDT posits that individuals are inherently motivated to grow, develop, and thrive when their basic psychological needs are met (Ryan & Deci, 2000a). These basic needs are autonomy, competence, and relatedness.

Autonomy, within the context of SDT, refers to the experience of behaviour as voluntary and self-endorsed (Deci & Ryan, 1985). In other words, when people are autonomous, they act in accordance with their own values, interests, and desires, rather than feeling compelled by external pressures or demands. Autonomy is not about being independent or isolated, but rather about feeling a sense of ownership over one's actions. This sense of autonomy supports the development of self-regulation, personal growth, and psychological well-being (Ryan & Deci, 2000b).

In an educational setting, autonomy can be fostered by providing students with opportunities to make choices, express their opinions, and participate in activities that are meaningful to them (Reeve, 2009). Research has shown that students who experience autonomy-supportive environments are more likely to exhibit greater motivation, engagement, and academic performance, as well as higher levels of well-being (Niemiec & Ryan, 2009).

## Autonomy, Competence & Relatedness

As mentioned at the beginning of the Literature Review (p3), SDT identifies three basic psychological needs that are essential for optimal motivation, development, and well-being. In addition to autonomy, competence and relatedness are also critical factors to consider when seeking to analyse student motivation and performance. All three of these needs are universal and interact with one another to influence an individual's motivation and behaviour. These interactions are explored in more detail below, drawing upon both the theoretical framework of SDT (Deci & Ryan, 1985; Ryan & Deci, 2000b), and the practical application of it to educational environments (Niemiec & Ryan, 2009; Vansteenkiste et al., 2009).

### *Autonomy and Competence*

Competence pertains to feeling effective and capable in one's interactions with the social environment and experiencing opportunities to exercise and express one's abilities (Deci & Ryan, 1985). This involves a sense of confidence in one's capacity to influence outcomes and achieve desired results. When people feel competent, they perceive that they can perform necessary tasks successfully and overcome challenges. When individuals feel autonomous and have the freedom to make choices, they are more likely to engage in activities that allow them to develop and improve their skills. Autonomy-supportive environments foster intrinsic motivation, which in turn enhances competence by encouraging individuals to persist in challenging tasks, explore new strategies, and seek feedback (Ryan & Deci, 2000a). Furthermore, students in autonomy-supportive classrooms have been shown to have a better perception of their competence, exhibit more interest and value in their work, and to be more likely to choose challenging tasks and show creativity (Niemiec & Ryan, 2009). Thus, autonomy and competence can be seen as closely related and mutually reinforcing.

### *Autonomy and Relatedness*

Relatedness reflects the universal desire to connect with others, to care and be cared for, and to belong to a community, encompassing an individual's feelings of being understood, loved, and valued by those around them (Deci & Ryan, 1985). Relatedness fulfils the human need for interpersonal relationships and social bonding. Autonomy and relatedness can sometimes seem to be in tension, as autonomy emphasizes individual choice, while relatedness involves connecting with others. However, they can also complement each other. For instance, in an educational context, when students feel that they have the autonomy to express their opinions and make choices, they are more likely to engage in collaborative activities and develop positive relationships with their peers and teachers (Niemiec & Ryan, 2009; Vansteenkiste et al., 2009). This sense of relatedness, in turn, can strengthen autonomous motivation, as individuals are more likely to engage in activities that are consistent with their values and interests when they feel supported and understood by others.

## The Benefits of Autonomy Support in Education

Previous research on autonomy-supportive activities has provided valuable insights into their outcomes in various educational contexts. These studies have demonstrated that autonomy-supportive interventions can lead to positive outcomes, including increased motivation, engagement, academic achievement, and psychological well-being. A number of these studies, and their findings, are presented below.

### *Intrinsic Motivation and Engagement*

Autonomy-supportive teaching practices have been linked to increased intrinsic motivation and engagement among students (Reeve, 2009; Stefanou et al., 2004). For instance, Reeve (2009) examined the reasons why teachers may adopt a controlling motivating style and suggested ways they can become more autonomy supportive. The author reviewed several studies that demonstrated a positive association between autonomy-supportive teaching practices and students' intrinsic motivation, curiosity, and enjoyment in learning. Additionally, the paper discussed intervention strategies to help teachers develop an autonomy-supportive teaching approach. While the use of findings from a range of different studies provides a comprehensive overview of the relationship between autonomy-supportive teaching and intrinsic motivation, it should be noted that the author

does not conduct a systematic analysis of the individual studies cited, which may limit the depth of the discussion on the strengths and limitations of the existing research.

Similarly, Stefanou et al. (2004) investigated how teachers can support autonomy in the classroom by encouraging student decision-making and ownership. The authors conducted classroom observations of 18 middle and high school teachers in the United States, followed by teacher interviews. The results indicated that autonomy-supportive practices were associated with higher levels of cognitive and emotional engagement among students. The mixed-methods approach employed by this study, combining classroom observations and teacher interviews, allowed for a more comprehensive understanding of the autonomy-supportive practices and their impact on student engagement. However, the sample size used was relatively small, with only 18 teachers, which may limit the extent to which finding from the study can be extrapolated. Furthermore, the study relied on observational data and teacher self-reports, which can be subject to biases and may not capture all aspects of autonomy-supportive teaching practices or student engagement.

*Academic Achievement*

A growing body of research has also established a positive relationship between autonomy-supportive practices and academic achievement (Jang et al., 2010; Niemiec & Ryan, 2009). Jang et al. (2010) investigated the effects of autonomy support and structure on student engagement in learning activities. The study was conducted in two parts: the first part involved classroom observations of teachers' instructional styles, and the second part involved an experimental manipulation of teachers' autonomy-supportive and structuring behaviours. The study included 133 high school students and 7 teachers from South Korea. The results showed that both autonomy support and structure positively predicted student engagement. Autonomy support was associated with students' feelings of volitional engagement, while structure was related to students' feelings of competent engagement. Importantly, students who experienced both autonomy support and structure showed better academic performance.

The combination of observational and experimental methods used in this study provides robust evidence for the impact of autonomy support and structure on student engagement and academic performance. Moreover, the authors challenge the notion that autonomy support and structure are mutually exclusive or that one is more important than the other, offering a more nuanced understanding of their combined effects on student outcomes. However, the fact that the study was

conducted in a single cultural context (South Korea), and that it had a somewhat small sample size – 133 students and 7 teachers – may limit the extent to which findings from the study can be generalised to other contexts and setting (particularly those with a different culture).

Additionally, Black & Deci (2000) investigated the effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry within the framework of SDT. The authors aimed to examine whether autonomy-supportive teaching practices would predict students' autonomous motivation and, in turn, affect their learning outcomes in a college-level organic chemistry course. Among other benefits of autonomy supportive teaching concerning students' motivation, the study found that students' autonomous motivation positively predicted their course performance (exam scores) and conceptual understanding (as measured by the American Chemical Society standardised test). These results indicate that when students are autonomously motivated to learn, they are more likely to achieve better academic outcomes.

The use by Black and Deci (2000) of multiple outcome measures – examining both exam scores and conceptual understanding – indicates high validity and robustness of the findings, as it allows for a more comprehensive assessment of the impact of autonomy support on students' learning outcomes. The study does, however, have some key limitations. Firstly, the small sample size (137 students) and narrowly defined context (a college-level organic chemistry course at a single university in the United States) restrict the applicability of the findings to other educational settings, subject areas, or cultural contexts. In addition to this, the study employed a cross-sectional design – in which data is collected at a single point in time from a sample of participants – whereas a longitudinal design or experimental approach could potentially have been more appropriate for examining causal relationships and assessing the long-term effects of autonomy-supportive teaching practices. Despite these limitations, I would suggest that Black and Deci's (2000) study contributes valuable insights into the role of autonomy support and autonomous motivation in promoting students' learning outcomes.

### *Psychological Well-Being*

Several studies have demonstrated the positive effects of autonomy-supportive interventions on students' psychological well-being (Deci, Vallerand, Pelletier, & Ryan, 1991; Vansteenkiste et al., 2009). Deci et al. (1991) provided an overview of self-determination theory (SDT) and its implications for motivation and education. The authors reviewed several studies that examined the

effects of autonomy support on students' well-being. They found that college students who experienced autonomy-supportive teaching reported higher levels of self-esteem, self-actualization, and general well-being. Although the authors present empirical research supporting the SDT perspective in education, the number of studies available at the time of publication was limited. More recent research has expanded upon these findings, providing a more robust evidence base for the SDT perspective in educational contexts. Furthermore, the paper focuses primarily on educational settings in Western countries, so further research is needed to examine the applicability of SDT – in particular relating to autonomy and psychological well-being – across a range of diverse cultural settings.

Vansteenkiste et al. (2009) reported similar findings to Deci et al. (1991), indicating that students who perceived their teachers as autonomy-supportive experienced higher levels of psychological well-being. In this study, the authors examined the role of autonomy support in students' motivational profiles and psychological well-being. The authors surveyed 698 high school students in Belgium, assessing their perceived autonomy support from teachers, the quality of their motivation, and indicators of psychological well-being. The results showed that students who perceived their teachers as more autonomy-supportive had higher levels of autonomous motivation, which in turn predicted greater psychological well-being. The findings therefore support the idea that autonomy-supportive teaching practices can have a positive impact on students' psychological well-being. The relatively large sample size (especially in comparison to many of the other papers concerning autonomy-supportive teaching) used in the study lends significant weight to the applicability of its findings to different educational contexts, however the use of self-report measures (and the potential for biases contained therein) must be taken into consideration. Furthermore, as with Deci et al. (1991), further research in the form of a longitudinal study is desirable, in order to better establish a causal relationship between autonomy supportive interventions and psychological well-being.

*Provision of Choice*

The provision of choice in education has been extensively studied within the framework of SDT, particularly focusing on its effects on autonomy, motivation, and academic outcomes (Assor, Kaplan, & Roth, 2002; Iyengar, & Lepper, 2000; Patall, Cooper, & Robinson, 2008). Patall et al. (2008) conducted a meta-analysis to examine the effects of choice on intrinsic motivation, effort,

task performance, and perceived competence. The results demonstrated that providing choice led to increased intrinsic motivation, effort, and perceived competence. However, the effects on task performance were somewhat weaker. While the meta-analytic approach of the study indicates good generalisability for its findings, it should be noted that the meta-analysis did not differentiate between types of choices (e.g., task choice, goal choice), which could itself be an important factor affecting motivation and attainment. Furthermore, the study did not investigate potential moderating variables, such as age, cultural context, or subject area, which could influence the effectiveness of choice provision.

Taking a somewhat different approach, Iyengar and Lepper (2000) explored the paradoxical effects of choice on motivation, satisfaction, and performance. The authors conducted a series of experiments in various consumer contexts, including a well-known "jam study," in which participants were presented with either a limited (6 varieties) or extensive (24 varieties) assortment of jams in a supermarket setting. Participants who were presented with the limited assortment were more likely to make a purchase and reported greater satisfaction with their selection than those presented with the extensive assortment. The authors extended these findings to other consumer contexts, such as choosing chocolates and writing essays. In each experiment, participants who were given a moderate number of options displayed greater motivation, satisfaction, and performance than those given either no choice or an excessive number of options. The researchers concluded that while choice is generally beneficial, excessive choice can lead to decreased motivation, decision paralysis, and lower performance, a phenomenon they termed "choice overload."

The introduction by Iyengar and Lepper (2000) of the concept of choice overload suggests the importance of finding an optimal level of choice provision in educational settings, with too much choice potentially leading to undesirable outcomes. However, it is important to consider that the study was conducted primarily in laboratory settings, with a focus mainly on choice in consumer contexts, which may limit the extent to which the findings can be extrapolated to real-world educational contexts.

Assor, Kaplan, and Roth (2002) investigated the effects of choice provision and perceived relevance on students' engagement in schoolwork. The researchers conducted a correlational study involving 862 Israeli high school students and their teachers. Students were asked to rate their teachers'

autonomy-enhancing and suppressing behaviours, as well as the perceived relevance of the schoolwork. The results showed that both choice provision and perceived relevance were positively related to student engagement in schoolwork. Interestingly, perceived relevance was found to be a stronger predictor of engagement than choice provision. The authors concluded that while providing choice is important for promoting student engagement, ensuring that choices are perceived as relevant to students' interests, goals, and values is even more crucial. While the large sample size and education-specific context of the study indicate strong validity of its findings, the decision to focus solely on engagement as an outcome measure, without examining other variables such as motivation, performance, or well-being, limits the applicability of the results somewhat to other educational outcomes.

**Summary**

In conclusion, the literature on autonomy and achievement, as well as the provision of choice in education, from an SDT perspective, has provided valuable insights into the positive effects of autonomy-supportive teaching practices on student motivation and academic outcomes. Research has consistently demonstrated that when teachers adopt an autonomy-supportive approach, students tend to experience increased intrinsic motivation, engagement, and better academic performance.

Moreover, the provision of choice has been shown to enhance students' autonomy, motivation, and academic outcomes. However, it is important to acknowledge the potential negative effects of excessive choice, which can lead to decreased motivation and performance. In addition, ensuring that choices are perceived as relevant to students' interests and goals is crucial for maximizing their engagement in schoolwork.

Despite these significant findings, several gaps in the literature remain. Future research should explore the impact of different types of choices on autonomy, motivation, and academic outcomes, as well as potential moderating variables such as age, cultural context, and subject area. Additionally, more studies are needed to investigate the optimal conditions for choice provision in various educational contexts.

Furthermore, longitudinal research designs should be employed to establish causal relationships between autonomy-supportive teaching practices, choice provision, and academic outcomes, as many existing studies rely on correlational or cross-sectional designs. Lastly, as online learning

environments continue to grow in prominence, it is crucial to compare the effects of autonomy-supportive practices and choice provision in traditional face-to-face settings with those in online learning contexts.

In this essay, I will seek to address the gap that exists in contemporary literature concerning the manner in which different types of choice affect learning and motivation. To achieve this, the essay will present findings from an experimental study conducted with a year 10 science class in a UK secondary school, where students were exposed to different levels of autonomy in their learning activities, through the provision of choice in both the nature and quantity of work they were expected to complete. The results of this study will then be discussed, including reference to the strengths and limitations present, with implications for educational practice and recommendations for future research identified.

## Methodology

As mentioned in the earlier introduction to this essay, the purpose of this of this investigation is to answer the following Research Question (RQ): "How do varying levels of autonomy, provided through different degrees of choice in the nature and quantity of work completed, affect learning and motivation outcomes in a Key Stage 4 science class?". This RQ identifies two different 'types' of choice to be examined by the study – choice in the quantity of work completed, and choice in the nature of work completed. As such, the central research question was broken down to form the following two sub questions (SQ), which were used to guide the research undertaken:

SQ1: Does giving students greater choice in the quantity of work they are expected to complete for homework increase the amount and quality of the work completed?

SQ2: Does giving students greater choice in the nature of revision work they complete improve subsequent attainment in formative tests?

These questions were subsequently examined through the implementation of autonomy-supportive interventions, in the form of tasks set both in lessons and as homework. These tasks were then completed by a single Year 10 science class in a UK comprehensive secondary school over the course of spring and summer term 2023, with data from the tasks subsequently collected and analysed.

## Research Approach

For this study, action research was chosen as the guiding approach for examining the central research question, and its constituent sub questions. Action research in the context of educational research refers to a reflective process of progressive problem-solving that allows educators to systematically investigate their own practice with the goal of improving it – for a more comprehensive definition of action research, see Kemmis, McTaggart, & Nixon, (2014) and chapter 14 in Cohen, Manion, & Morrison (2017). This type of research is typically conducted within the researcher's own educational environment—such as their classroom, school, or district—and involves a cycle of questioning, collecting data, reflecting on the findings, and implementing changes based on those findings.

In a typical action research cycle, an educator might begin by identifying a problem or question related to their practice. They would then collect data related to this problem, analyse this data, and develop a plan of action to address the problem, usually in the form of some classroom intervention. After implementing this plan, they would observe the effects and reflect on what they learned, potentially leading to a new research question and a new cycle of action research. In this way, action research can be seen as an "approach to improving education by changing it, measuring the effect of the change, and learning from its consequences, in which the active participation of the educator in the research can lead to an improvement in their own practices, in addition to those of the school, trust, or wider educational community" (Cohen et al., 2017, pp.299-300).

In accordance with this template, the research proceeded in the following manner. An autonomy-supportive intervention was developed to address each of the two sub questions, guided by the literature. The intervention was then trialled with the target class, after which various data would then be collected and analysed, in order to assess the effectiveness of the intervention, as well as to identify any other notable consequences.

## Data Collection

The research undertaken for this study employs a mixed-methods approach, as outlined by Bell and Waters (2018, pp.107-130), combining elements of both quantitative and qualitative research with the aim of addressing the central research question (and related sub-questions) more comprehensively. By combining quantitative and qualitative methods, Bell and Waters (2018)

suggest that researchers can provide a richer, more nuanced understanding of a research problem. Quantitative data can offer generalisable findings and identify patterns, while qualitative data can explore the underlying meanings, context, and participants' perspectives.

This approach was chosen due to the complexity of the outcome that the central research question seeks to measure – the impact on 'learning and motivation' of a Key Stage 4 science class. While it is tempting to rely heavily (or even perhaps entirely) on test grades, quantity of work produced, or some other quantitative measure to assess the extent to which learning has taken place, we must always bear in mind that learning is a multifaceted, holistic process that includes cognitive, emotional, and social development. Learning may also manifest itself in higher-order thinking skills, problem-solving abilities, and creativity – quantities which can be difficult to identify and assess through the use of standardised testing (Darling-Hammond, 2000).

In a similar way, the motivation of an individual is something that is difficult to fully assess purely through quantifiable metrics. Although research within the framework of SDT has identified a number of highly valuable quantitative methods of measuring and classifying motivation – in particular the Self-Regulation Questionnaire (SRQ; Ryan & Connell, 1989), the Academic Motivation Scale (AMS; Vallerand et al., 1992), and the Relative Autonomy Index (RAI; Grolnick & Ryan, 1987) – qualitative methods can add rich, in-depth insights, which permit a more comprehensive understanding of individuals' motivation and the factors that influence it. For example, classroom observations can qualitatively assess how students engage in learning activities, providing information on the autonomy and control aspects of their motivation.

In this investigation, data sources generally fell into four categories. These categories, along with the SQs that they served to address, are presented below in Table 1 (next page).

**Ethics**

The ethical considerations of this research were meticulously aligned with the standards set forth in the British Educational Research Association (BERA) guidelines. These guidelines are detailed in the BERA's "Ethical Guidelines for Educational Research" (British Educational Research Association, 2018), which provided the foundation for ensuring ethical integrity throughout the research process. They emphasise respect for the dignity, rights, and privacy of all participants, which was a guiding principle in this study.

| **Research Question** | Does increasing student autonomy by granting greater choice over the nature and quantity of the work that they complete lead to improved learning and motivation outcomes? | | | |
|---|---|---|---|---|
| **Sub questions** | **Data Source 1** Notes from observing teacher | **Data Source 2** Questionnaires (students rate statements from 1-5) | **Data Source 3** Marking completed homework | **Data Source 4** Student records from the 'Go4Schools' website |
| ***SQ1**: Does giving students greater choice in the nature of revision work they complete improve subsequent attainment in formative tests?* | ✓ | ✓ | x | ✓ |
| ***SQ2**: Does giving students greater choice in the quantity of work they are expected to complete for homework increase the amount and quality of the work completed?* | x | x | ✓ | ✓ |
| **Period of data collection** | Spring-Summer Term 2023 | Spring-Summer Term 2023 | Summer Term 2023 | Throughout the placement |

**Table 1: An overview of the data collection methods employed throughout this research, by sub question**

In this research, direct consent from students or guardians was not required due to the nature of data collection. Instead of conducting face-to-face case study interviews or collecting personally identifiable information, the study utilised exclusively anonymised data. This included questionnaires in which the name of the student was not recorded (Data Source 2), marks from completed homework tasks taken from exercise books – with recorded data identifying each student with a unique number in place of their name (Data Source 3), and data from the 'Go4Schools' software, from which only individual test scores were taken (Data Source 4). The anonymisation of data was in strict compliance with the General Data Protection Regulation (GDPR), ensuring the privacy and confidentiality of student information. Throughout the study, the handling of data was governed by strict confidentiality and privacy protocols. All anonymised data collected was securely stored and handled, accessible exclusively to myself for the purpose of analysis.

The Faculty's guidelines were strenuously followed throughout the entirety of the study, and were considered from the earliest stages of the research design, which was achieved through frequent meeting and discussions with the Physics Subject Lecturer and other faculty members. Furthermore, the research was developed and implemented in consultation with relevant School staff, including the regular teachers of the target class, heads of subject and department, and the professional tutor responsible for overseeing the PGCE trainees. These consultations were integral to ensuring that the research interventions were ethically and contextually appropriate within the educational setting. The input from educational professionals also helped to align the research with the real-world educational environment, enhancing its relevance and applicability.

A deliberate choice was made to measure the success of one of the autonomy-supportive interventions against student performance in tests that were both formative and explicitly low-stakes (so called ‘keystone’ tests, discussed in further detail in the following section). This was done to mitigate the impact any unforeseen negative effects or consequences that the intervention might have for the students, which could potentially result in significant distress if followed by a high-stakes, summative assessment in which the students’ confidence and performance were compromised.

## Research Design

As outlined in the methodology above, the action research performed in this study consisted of an autonomy-supportive intervention, which was then followed by collection and analysis of relevant data. This section will describe in further detail how these interventions were carried out, and the form of the data that were to be collected, for each of the two SQs guiding this research.

### Participants

The participants in the research presented in this essay were a Year 10 science class from a state comprehensive secondary school in the United Kingdom. Students in the class were completing the combined science GCSE qualification, and were considered to be a ‘higher prior attaining’ group (equivalent to more traditional ‘second set’ designation, based on the division of a year group into four or five sets total). As such, the average target grade of this class was between a 6 and a 7 (with 9 being the highest attainable grade), with range of target grades from 3 to 9. Prior to the

commencement of this research, prior mock examinations had determined that students in this class were on average performing at or slightly above their target grades.

The reasons for the selection of this class were fourfold. Firstly, it was deemed that the behaviour of this class was at an appropriate level as to be both suitable for a trainee teacher (myself), and also for trialling novel forms of lessons and activities without running the risk of excessive disruption. Secondly, the timetable for this class corresponded conveniently to my own teaching timetable, avoiding any conflicts or other scheduling problems. Thirdly, the regular teacher for this class happened also to be my mentor for the professional placement I was completing at the school, allowing for greater collaboration throughout the research project (in particular having my mentor perform lesson observations to contribute to the research). Finally, the prior attainment level of the class was deliberately selected to be high, but with 'room for improvement'. While autonomy-supportive measures have been demonstrated to positively affect learning and motivation outcomes regardless of attainment level (Patall et al., 2008; Sierens et al., 2009), lower prior attaining classes tended to present more problems regarding disruptive behaviour, so were deemed unsuitable. Furthermore, the choice of a class that was not the highest prior attaining (equivalent to the traditional 'top set') was made so as to open up the possibility of better assessing whether increasing autonomy and student choice could produce a tangible increase in exam attainment (since the higher attaining class had an average target grade of between 7 and 8, and hence less 'room for improvement').

**Sub Question 1 (SQ1): Does giving students greater choice in the quantity of work they are expected to complete for homework increase the amount and quality of the work completed?**

This SQ was chosen due to the fact that the frequent completion of homework and independent revision has been shown to offer a wide range of benefits to secondary school students – for example in terms of improved academic achievement (Cooper et al., 2006), development of time management and study skills (Corno & Xu, 2004), greater responsibility and self-discipline (Zimmerman & Kitsantas, 2005), and reinforcement of learning (Bjork et al., 2013). It follows, therefore, that interventions leading to increased completion of homework and independent revision in students will lead to greatly improved outcomes. As such, an autonomy-supportive intervention involving the provision of greater choice in the quantity of homework done by each student was

designed, in order to determine whether this would increase students' willingness to complete more homework (and independent work generally).

*Intervention*

This autonomy-supportive intervention took the form of a weekly homework task, composed of ten multiple choice questions related to the content covered in the lesson after which they were set. Students were informed (both verbally by the teacher at the end of the lesson, and in writing via instructions at the top of the homework sheet) that for the homework to be considered 'done', they must complete a minimum of three of the questions on the sheet. If fewer than three questions were completed, then students would be subject to the standard sanctions for homework non-completion set out by the school (that being a 40-minute 'homework support' lunchtime detention). Beyond the minimum three question requirement, students were given the choice of attempting as many further questions as they wished – up to all of the ten available if they were so inclined. Three such homeworks were set (on non-consecutive weeks), in order to assess whether there were any effects that manifested over time.

The questions set for each homework task were taken from the 'Best Education Science Teaching' (BEST) diagnostic question resources developed by the University of York in the United Kingdom (University of York Science Education Group, 2022). This decision was made due to the fact that the BEST resources are designed with a consciously evidence-based approach – working alongside both educational researchers and practicing teachers. In particular, their diagnostic questions have been designed specifically to serve as a formative assessment tool – providing feedback to the learner and to the teacher which is then used to help decide what to do next (University of York Science Education Group, 2022).

In addition to these questions, students were also given mark schemes for the homeworks, which not only specified the answers to the multiple-choice questions, but provided a justification for each correct answer. This decision was made for a number of reasons – firstly, when students self-mark their work, they receive immediate feedback on their performance. This immediate feedback allows students to identify errors and misconceptions, and to correct them before they become ingrained (Hattie & Timperley, 2007). In addition to this, research suggests that timely and specific feedback is crucial for learning (Shute, 2008). Secondly, self-assessment (self-marking) gives students a sense of ownership over their learning. This can increase motivation and engagement (Black &

Wiliam, 1998), and can make students more likely to internalize the learning objectives and strive for improvement (Andrade & Valtcheva, 2009) by giving them a sense of responsibility for evaluating their own work.

*Data Collection*

The data used for assessing the effectiveness of this intervention consisted primarily of recording the number of questions that each student attempted for each individual homework task. Furthermore, it would be noted whether the student had marked their work or not. These results were collected and inputted into a Microsoft Excel spreadsheet for analysis.

Additionally, data pertaining to student homeworks completed earlier in the school year was retrieved from the 'Go4Schools' education management software used by the school. This information was to serve as a potential reference point against which to compare various metrics from the intervention, such as noncompletion rate.

**Sub Question 2 (SQ2): Does giving students greater choice in the nature of revision work they complete improve subsequent attainment in formative tests?**

This SQ was chosen deliberately to contrast with the previous SQ, and hence to allow the research to address the gap in the research identified in the literature review, concerning the effect of different types of choices on autonomy, motivation, and academic outcomes. Whereas the previous SQ can be seen as constraining the nature of the work, while providing choice of the quantity of work completed, this SQ seeks to do the inverse – constrain the quantity of work completed, while providing choice regarding the nature of the work completed. In order to evaluate whether greater choice in the nature of work completed would improve student learning and motivation outcomes, an autonomy-supportive intervention was designed wherein students would be given greater choice over the type of revision they completed in preparation for a subsequent end-of-unit test.

*Intervention*

This autonomy-supportive intervention was carried out over the course of a double lesson (with a duration on 100 minutes total), in which the first half was dedicated to revision on the topic covered over the course of the previous five or six weeks, with the second half dedicated to the completion

and marking of so-called 'keystone' tests. These keystone tests are set as low-stakes, end of unit formative assessments to be completed in test conditions, providing both teacher and student with feedback as to how the student is progressing (and further to serve as important practice for the final GCSE exams).

Students participating in this lesson were informed of the keystone test to be completed in the second half, and were then given a choice of 4 separate revision activities. These were as follows:

- To complete a set of practice questions on the topic, taken from a range of past exam papers relevant to the course specification.
- To complete a guided 'revision map', which guided students' note making by providing prompts on various aspects of the topic.
- To produce a 'mind map' or equivalent revision notes page in their book, using the course revision guide for assistance.
- To complete a quiz from the 'Educake' website, which produces interactive quizzes based on the specification of various UK secondary school qualifications.

Following these instructions, students were then informed that they were expected to produce at least one side of a4 paper's worth of work (in keeping with the desire to limit choice in the quantity of work done). Once the first fifty minutes of the lesson had elapsed, students were instructed to put their revision work away (so that it could not be seen), and were then given the keystone tests to complete.

*Data Collection*

In order to assess the effectiveness of this intervention, three sources of data were considered. Firstly, the marks attained by each student on the subsequent test were recorded. While not considered to be an authoritative measure of the effectiveness of the intervention on student attainment, this information was nonetheless considered worth collecting, in case any noteworthy features were present.

Secondly, students were given a short questionnaire immediately following the marking portion of the lesson. This questionnaire asked the students to rate four statements about the lesson – and subsequent keystone test – from 1 to 5, with a rating of 1 representing 'strongly disagree', 3

representing ‘neutral’, and 5 representing ‘strongly agree’. The statements that the students were asked to evaluate are as follows:

- “I felt prepared for this keystone”
- “I feel like I did well on this keystone”
- “I feel like the revision completed before the keystone was helpful”
- “I would like to have more revision lessons like this in the future”

The third source of data collected for evaluating this intervention consisted of a set of notes made by a second teacher observing the lesson. The teacher carrying out the observation had taught the participant class recently, and hence was deemed to have a more thorough understanding of the behaviour of the class. The observing teacher was prompted before the intervention lesson to note in particular indicators of class engagement, such as off task conversations, or conversely groups of students in periods of deep focus.

Given the qualitative nature of the data from the classroom observation, an inductive approach to coding was used to analyse this source of data. This approach started with pre-identified themes, or codes, which were chosen based on their relevance to the research question.

The following codes were used:

1. **Motivation:** Instances where students demonstrated eagerness, interest, or investment in the tasks.
2. **Engagement:** Divided into Active Engagement (signs of students actively participating in tasks, including answering questions, raising hands for help, or working on tasks) and Passive Engagement (signs of passive participation or disengagement, such as restlessness or off-task conversations).
3. **Peer Interaction:** Instances of students working together, discussing tasks, or helping each other.
4. **Classroom Environment:** Observations about the general atmosphere of the classroom, including teacher facilitation, student discipline, and the overall learning environment.
5. **Autonomy:** Instances of students demonstrating autonomy in their learning, such as choosing tasks independently, seeking extension activities, or marking their own work.

The data was initially reviewed to ensure its relevance to the codes, with portions of the data highlighted and annotated with the corresponding codes. This was done iteratively to ensure

accurate and thorough coding. Following this, the coded data was reviewed, and codes were refined and adjusted to better fit the data. Finally, the coded data was analysed to extract key insights relevant to the research question.

## Findings

Presented below are findings from the data collected about the two autonomy-supportive interventions that were undertaken as part of this research. Results from each source of data outlined in the methodology are shown separately, with analysis and interpretation of these results discussed in the following section.

### Data Source 1: Notes from Observing Teacher

The observation of the classroom during the autonomous revision lesson intervention, made by a second teacher, yielded several insights related to the five chosen themes: Motivation, Engagement (Active and Passive), Peer Interaction, Classroom Environment, and Autonomy.

**Motivation:** The observation notes implied that students exhibited a high level of motivation when engaged with the autonomy-supportive tasks. This was noted when students eagerly chose their tasks, completed them, and, in some cases, sought to extend their learning by asking for another task upon completion.

**Engagement:** Two types of engagement emerged from the observation notes, active and passive. Active engagement was observed in a majority of the students as they attentively listened to task explanations, swiftly made their choices, and engaged with their tasks. Some students, however, demonstrated signs of passive engagement, indicated by instances of restlessness or off-task conversations.

**Peer Interaction:** The observation notes highlighted that the autonomy-supportive tasks facilitated peer interaction. Students were observed forming pairs or groups, discussing their tasks, and helping each other. However, there were instances where peer interactions drifted away from the tasks, indicating off-task behaviour.

**Classroom Environment:** The notes portrayed a generally positive classroom environment. The teacher was observed to successfully facilitate the learning process, maintain discipline, and refocus

students when needed. The atmosphere was described as a 'buzz', indicating an active and engaging learning environment.

**Autonomy:** The autonomy-supportive tasks seemed to effectively foster student autonomy. This was seen when students made their own choices regarding tasks and when they had the freedom to choose another task if they completed their initial one early.

The observation data indicates that the intervention was largely successful in fostering a positive and autonomous learning environment. Some areas for improvement were identified, such as providing additional activities for early finishers to sustain engagement, and better managing off-task conversations.

**Data Source 2: Questionnaires (students rate statements from 1-5)**

The results from the student questionnaires provide insights into the students' perceptions of the intervention. The average rating for feeling prepared for the test was 2.67, indicating a neutral to slightly negative perception of preparedness. However, students' feelings about their performance on the test and the helpfulness of the revision were more positive, with average ratings of 3.33 and 3.58 respectively. Finally, the highest-rated statement was regarding a desire for more similar revision sessions in the future, with an average rating of 3.96. This implies a generally positive response to the autonomy provided in the revision session, although the somewhat lower perception of preparedness warrants further consideration.

**Data Source 3: Marking Completed Homework Tasks**

During the intervention, the homework tasks were assessed over a three-week period. The completion rate remained fairly consistent across the weeks, with rates of 92%, 88%, and 92% for weeks 1, 2, and 3 respectively. This shows a strong engagement from the majority of the students.

Additionally, the average number of questions attempted showed an incremental increase across the weeks. In the first week, the mean average was 5.64 questions attempted, rising to 5.72 in the second week and 5.92 in the third week. This may indicate an increased willingness to go beyond the minimum requirements of the task, although the effect is somewhat small at this stage.

Furthermore, the number of students who self-marked their work also saw a progressive increase. Initially, 12 students marked their own work in the first week. This number rose to 14 in the second week, and then to 16 in the third week (out of a total of 25 students). This could potentially highlight a growing sense of responsibility and engagement with their own learning process.

**Data Source 4: Student Records from the 'Go4Schools' Website**

**SQ1:** In terms of homework completion rate, there was an increase when compared with the rate prior to the intervention. Historical data from Go4Schools showed an average homework completion rate of 84.23% over the two terms before the intervention, whereas the average rate during the intervention was 90.67%. This suggests a positive impact of the intervention on homework completion rates, although the difference is relatively small.

**SQ2:** When comparing the average keystone test grade after the intervention (62.73%) with the grades of two previous similar tests (average of 65.12%), there was a slight decrease. Although the tests covered different topics, this data indicates a possible negative effect of the intervention on the test performance.

## Discussion

This discussion will synthesise the findings of this research pertaining to the role of student autonomy in educational settings, with particular reference to the impact of providing choice in the quantity and nature of homework and revision tasks. The central research question focused on understanding of how increased autonomy could improve learning and motivation outcomes, both through greater choice in quantity of work completed (SQ1), and through choice in the nature of work completed (SQ2).

In assessing these SQs, action research was undertaken in the form of a two-fold intervention strategy: an autonomous homework intervention and an autonomous revision lesson intervention. In light of these approaches, the subsequent analysis unpacks our findings in relation to each SQ, drawing on the broader body of research to shed further light on the implications of our results for educational practices and future research directions.

**Does giving students greater choice in the quantity of work they are expected to complete for homework increase the amount and quality of the work completed?**

The implementation of an autonomy-supportive homework intervention yielded promising results. Go4Schools data indicated a modest improvement in homework completion rates from the pre-intervention average of 84% to 92% by the third week of the intervention. Concurrently, both the volume and quality of homework completed also showed a modest increase over time, with average number of questions attempted increasing from 5.64 to 5.92 – a 4.96% increase, and the number of students self-marking their work increasing from 12 to 16 (out of a possible 25) – a 33.33% increase. These findings align with SDT literature which suggests that autonomy-supportive practices can foster greater intrinsic motivation and engagement (Ryan & Deci, 2000b).

The increase in student self-marking over time (33.33%) may be of particular note. Self-marking, as a form of self-assessment, is considered a valuable self-regulatory skill, which aligns with the autonomous learning advocated by SDT. A number of studies have suggested that students who practice self-assessment have improved learning and motivation outcomes (Andrade & Valtcheva, 2009; Panadero & Alonso-Tapia, 2013; Ross, 2006). The increasing number of students self-marking over the course of this intervention may suggest a gradual increase in autonomous behaviours, consistent with the emphasis on autonomous motivation in SDT.

However, it is important to consider the nuanced relationship between autonomy, competence, and relatedness – the three basic psychological needs outlined in SDT. The intervention's success may also be attributed to increased competence through repeated practice and the use of a clear marking scheme. Relatedness may have been fostered through the shared experience of a novel homework approach and potential peer discussions.

Although promising, these findings also raise questions about the sustainability and long-term impacts of such interventions. SDT emphasises the importance of ongoing autonomy-supportive practices (Ryan & Deci, 2000b), suggesting that the observed improvements in homework completion and self-marking would need to be sustained through consistent autonomy-supportive practices.

Moreover, considering the role of teachers in creating autonomy-supportive environments, further investigation could explore how teachers perceive and implement such homework interventions,

and what challenges or benefits they experience. Grolnick and Ryan (1987) highlight that teachers' understanding and support of students' autonomy is key in implementing successful autonomy-supportive interventions.

**Does giving students greater choice in the nature of revision work they complete improve subsequent attainment in formative tests?**

The intervention of giving students greater choice in the nature of revision work showed mixed results. Observation notes coded for autonomy, engagement, and classroom environment, alongside questionnaire responses, highlight that students felt generally positive about the experience. Notably, the most highly ranked statement was a desire for more revision lessons of this nature (average rating 3.96). This aligns with the literature suggesting that autonomy-supportive environments can improve student motivation (Reeve, 2006).

However, when comparing keystone test scores pre and post-intervention (Go4Schools data), students' performance showed a slight decline from the pre-intervention average (from 65.12% to 62.73%). The disparity between the perceived helpfulness of the revision session (average rating 3.58) and the actual impact on test performance prompts further reflection. This is perhaps reflected in the fact that students responded slightly negatively when asked if they felt prepared for the keystone test (2.67), which may be a truer reflection of how effective they considered the revision work. It is important to consider that the content of the previous tests differed greatly, covering different topics that can vary greatly in difficulty. Furthermore, the tests are not intended to be standardised in any way, and thus comparing performance like-for-like is likely not a hugely effective barometer for the effectiveness of the intervention.

Nevertheless, this finding underscores the complexity of applying autonomy-supportive teaching methods in practice. Literature highlights that the positive impacts of autonomous learning depend not only on the presence of choice, but also on learners' ability to effectively manage and make use of this autonomy (Sierens et al., 2009). It is plausible that some students may need further support or training in self-regulated learning strategies to fully benefit from an autonomy-supportive revision environment.

Interestingly, observation notes show instances of collaborative learning arising organically during the revision lesson, which is considered an effective learning strategy (Johnson & Johnson, 2009).

This suggests that the nature of tasks offered might play a role in stimulating beneficial learning interactions. Future research could focus on the design of revision tasks that not only cater to diverse learning preferences, but also stimulate collaborative and effective learning strategies.

## Implications for Research

This research offers some potentially valuable insights into the implementation and effects of autonomy-supportive practices in a classroom setting. However, longitudinal studies may better illuminate the long-term impacts and sustainability of such interventions. Additionally, gathering data on teacher perspectives could provide a fuller understanding of the process and challenges involved. Future research could also consider a more diverse set of indicators for autonomy and engagement, such as student feedback, and an in-depth analysis of the quality of work completed in homework tasks.

## Implications for Practice

The findings from this study underscore the potential benefits of autonomy-supportive practices in fostering student engagement and self-regulatory skills. Teachers may consider incorporating more choice in homework tasks, coupled with clear guidance and expectations, to stimulate students' autonomous motivation. Further, the practice of self-marking can serve as a valuable tool for enhancing students' self-assessment skills, as well as their understanding of the task requirements and expectations, contributing to better learning outcomes.

## Conclusion

This study explored the impacts of autonomy-supportive interventions on student learning and motivation, through the provision of increased choice in both the quantity and nature of the work they completed. The data suggested that implementing autonomous homework tasks increased homework completion rates from an average of 84% (pre-intervention) to 92% by the third week of the intervention. In addition, the quantity of homework completed showed a modest increase over the course of the intervention (from 5.64 to 5.92 out a possible 10 questions attempted on average), and more students progressively engaged in self-marking of their work over time, rising from 12 in

the first week to 16 in the third week. While the independent revision intervention resulted in mixed student feedback and slightly lower test scores compared to prior tests, it showed promising signs of engagement during the classroom observations. These findings are indicative of the benefits of autonomy-supportive strategies in improving engagement and fostering self-regulation, in line with the Self-Determination Theory. Yet, the value of consistent application of these practices for sustained benefits is crucial. This study could be a useful step towards gaining a more comprehensive understanding of the practical implications and potential long-term impacts of such interventions in classroom settings.

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