A Classification System for Teachers' Motivational Behaviours Recommended in Self-Determination Theory Interventions

Asghar Ahmadi[1], Michael Noetel[1], Philip Parker[1], Richard M. Ryan[1], Nikos Ntoumanis[2,3], Johnmarshall Reeve[1], Mark Beauchamp[4], Theresa Dicke[1], Alexander Yeung[1], Malek Ahmadi[5], Kimberley Bartholomew[6], Thomas K.F. Chiu[7], Thomas Curran[8], Gokce Erturan[9], Barbara Flunger[10], Christina Frederick[11], John Mark Froiland[12], David González-Cutre[13], Leen Haerens[14], Lucas Matias Jeno[15], Andre Koka[16], Christa Krijgsman[17], Jody Langdon[18], Rhiannon Lee White[19], David Litalien[20], David Lubans[21], John Mahoney[1], Ma. Jenina N. Nalipay[7], Erika Patall[22], Dana Perlman[23], Eleanor Quested[24], Sascha Schneider[25], Martyn Standage[26], Kim Stroet[27], Damien Tessier[28], Cecilie Thogersen-Ntoumani[2], Henri Tilga[16], Diego Vasconcellos[1], Chris Lonsdale[1]

[1] Australian Catholic University, Sydney, Australia

[2] University of Southern Denmark, Odense, Denmark

[3] Halmstad University, Halmstad, Sweden

[4] University of British Columbia, Vancouver, Canada

[5] Department of Sport Sciences, Urmia Branch, Islamic Azad University, Urmia, Iran

[6] University of East Anglia, Norwich, England

[7] The Chinese University of Hong Kong, Hong Kong SAR, China

[8] London School of Economics and Political Science, London, England

[9] Pamukkale University, Denizli, Turkey

[10] Utrecht University, Department of Pedagogical and Educational Sciences, Utrecht, Netherlands

[11] Embry-Riddle Aeronautical University, Florida, USA

[12] Purdue University, West Lafayette, USA

[13] Miguel Hernández University, Department of Sport Sciences, Elche, Spain

[14] Ghent University, Ghent, Belgium

[15] University of Bergen, Bergen, Norway

[16] University of Tartu, Tartu, Estonia

[17] Eindhoven University of Technology, Eindhoven, the Netherlands

[18] Georgia Southern University, Statesboro, USA

[19] Western Sydney University, Penrith, Australia

[20] Université Laval, Quebec, Canada

[21] College of Human and Social Futures, University of Newcastle, Newcastle, Australia

[22] University of Southern California, California, USA

[23] University of Wollongong, Wollongong, Australia

[24] Curtin University, Perth, Australia

[25] University of Zurich, Zurich, Switzerland

[26] University of Bath, Bath, England

[27] Leiden University, Institute of Education and Child Studies, Leiden, Netherlands

[28] Université Grenoble Alpes, Grenoble, France

Author Note

Asghar Ahmadi https://orcid.org/0000-0001-8710-1653

Michael Noetel https://orcid.org/0000-0002-6563-8203

Philip Parker http://orcid.org/0000-0002-4604-8566

Richard M. Ryan https://orcid.org/0000-0002-2355-6154

Nikos Ntoumanis https://orcid.org/0000-0001-7122-3795

Johnmarshall Reeve https://orcid.org/0000-0002-6827-293X

Mark Beauchamp https://orcid.org/0000-0001-8909-3896

Theresa Dicke https://orcid.org/0000-0001-8868-2242

Alexander Yeung https://orcid.org/0000-0003-3462-947

Malek Ahmadi https://orcid.org/0000-0002-5349-7490

Kimberley Bartholomew https://orcid.org/0000-0002-0171-7922

Thomas K.F. Chiu https://orcid.org/0000-0003-2887-5477

Thomas Curran https://orcid.org/0000-0003-2443-5079

Gokce Erturan https://orcid.org/0000-0002-1461-2679

Barbara Flunger https://orcid.org/0000-0001-8111-1228

Christina Frederick https://orcid.org/0000-0003-4637-7842

John Mark Froiland https://orcid.org/0000-0002-2700-3987

David González-Cutre https://orcid.org/0000-0002-8584-3992

Leen Haerens https://orcid.org/0000-0001-5715-9520

Lucas Matias Jeno https://orcid.org/0000-0003-3160-9313

Andre Koka https://orcid.org/0000-0002-2011-8650

Christa Krijgsman https://orcid.org/0000-0003-4979-633X

Jody Langdon https://orcid.org/0000-0002-5589-1694

Rhiannon Lee White https://orcid.org/0000-0002-5118-6226

David Litalien https://orcid.org/0000-0002-2456-3161

David Lubans https://orcid.org/0000-0002-0204-8257

John Mahoney https://orcid.org/0000-0002-1056-7348

Ma. Jenina N. Nalipay https://orcid.org/0000-0002-1401-9648

Erika Patall https://orcid.org/0000-0003-3448-8932

Dana Perlman https://orcid.org/0000-0003-3349-6420

Eleanor Quested https://orcid.org/0000-0002-6211-9045

Sascha Schneider https://orcid.org/0000-0003-4690-3777

Martyn Standage https://orcid.org/0000-0002-9683-8590

Kim Stroet https://orcid.org/0000-0001-6775-4454

Damien Tessier https://orcid.org/0000-0002-0728-585X

Cecilie Thogersen-Ntoumani https://orcid.org/0000-0003-0255-1263

Henri Tilga https://orcid.org/0000-0002-6363-4882

Diego Vasconcellos https://orcid.org/0000-0002-7948-3740

Chris Lonsdale https://orcid.org/0000-0002-2523-5565

Correspondence concerning this article should be addressed to Michael Noetel, School of Health and Behavioural Sciences, Australian Catholic University, 1100 Nudgee Road, Banyo, Queensland 4014 Australia. Email: michael.noetel@acu.edu.au

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Competing Interests

The authors declare that they have no competing interests.

Ethics Approval

The questionnaire and methodology for this study was approved by the Human Research Ethics committee of the Australian Catholic University (Approval Number: 2016-160E)

Data and Code Availability

The study materials and analysis code of this study are available at https://osf.io/apvyf/?view_only=5f7d11df23a142f58b7bf0080dad3e73. The raw data of this study are not available.

Preregistration

This study was not preregistered

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Abstract

Teachers' behaviour is a key factor that influences students' motivation. Many theoretical models have tried to explain this influence, with one of the most thoroughly researched being self-determination theory (SDT). We used a Delphi method to create a classification of teacher behaviours consistent with SDT. This is useful because SDT-based interventions have been widely used to improve educational outcomes. However, these interventions contain many components. Reliably classifying and labelling those components is essential for implementation, reproducibility, and evidence synthesis. We used an international expert panel ($N = 34$) to develop this classification system. We started by identifying behaviours from existing literature, then refined labels, descriptions, and examples using the experts' input. Next, these experts iteratively rated the relevance of each behaviour to SDT, the psychological need that each behaviour influenced, and its likely effect on motivation. To create a mutually exclusive and collectively exhaustive list of behaviours, experts nominated overlapping behaviours that were redundant, and suggested new ones missing from the classification. After three rounds, the expert panel agreed upon 57 teacher motivational behaviours that were consistent with SDT. For most behaviours (77%), experts reached consensus on both the most relevant psychological need and influence on motivation. Our classification system provides a comprehensive list of teacher motivational behaviours and consistent terminology in how those behaviours are labelled. Researchers and practitioners designing interventions could use these behaviours to design interventions, to reproduce interventions, to assess whether these behaviours moderate intervention effects, and could focus new research on areas where experts disagreed.

Keywords

Taxonomy, engagement, intervention design, behaviour change techniques, BCT

Educational impact and implications statement

The things teachers do in class have an important influence on their students' motivation, engagement, and learning. This study uses an international expert panel to identify the teacher behaviours most likely to influence motivation—specifically, teacher behaviours that increase the more healthy, autonomous motivation that comes from within students. This list of behaviours, agreed upon by the experts, could be used by teachers trying to improve their practice, policymakers trying to scale interventions, and researchers trying to assess which behaviours best predict student outcomes.

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Teachers' behaviour helps determine the quality of students' motivation and their engagement at school (Korpershoek et al., 2016; Lazowski & Hulleman, 2016; Reeve, 2009; Reeve & Cheon, 2021; Reeve & Jang, 2006; Ryan & Deci, 2017; Vasconcellos et al., 2020). When teachers foster high quality, autonomous motivation in their students, there are multiple behavioural, cognitive, and affective benefits (Bartholomew et al., 2018; Jang et al., 2010; Reeve et al., 2004; Tessier et al., 2010). Autonomously motivated students are more engaged in classroom activities and achieve better academic outcomes, compared with their less autonomously motivated peers (Froiland & Worrell, 2016; Gottfried et al., 2008; Howard et al., 2021; Reeve, 2009; Vansteenkiste et al., 2008). Unfortunately, student motivation often deteriorates over time and teacher behaviour plays a moderating role in this regard (Gillet et al., 2012; Gnambs & Hanfstingl, 2016; Lepper et al., 2005). That is, some teachers accelerate this decline while others can reverse the trend.

To harness the power of teachers to make a difference to student motivation, researchers have designed interventions grounded in self-determination theory (SDT; Ryan & Deci, 2020). Such interventions aim to help teachers foster students' autonomous motivation by learning to become more supportive of their psychological needs (for a review, see Reeve & Cheon, 2021). These teacher-focused interventions have been applied from early childhood to adult learning, across a range of subject domains, and in 17 different nations (Reeve & Cheon, 2021). These interventions usually comprise multiple components, such as taking students' perspectives, offering meaningful choices, and offering rationales (Cheon et al., 2012; Reeve et al., 2019). Yet, it is often difficult for readers of the subsequent publications to identify what components were used in an intervention, which component was most effective, or what each component represents in practice (Craig et al., 2008; Lazowski &

Hulleman, 2016; Rosenzweig & Wigfield, 2016). This happens because intervention programs may contain different components, components may be incompletely reported, or the same components may have been labelled differently (Michie et al., 2011; Michie, Fixsen, et al., 2009). These problems present barriers to implementation, replication, and synthesis of scientific evidence. Without a good classification system of teacher motivational behaviours, it is difficult for primary research to replicate effective interventions, for secondary research to synthesise the effectiveness of such interventions (e.g., reviews and individual participant analyses; Higgins et al., 2021), and for practitioners to implement those interventions faithfully (Moreau & Gamble, 2020). As a solution to these problems, classification systems for intervention components are common practice in health and medicine where they serve to increase the quality of interventions and research (Michie et al., 2011; Teixeira et al., 2020). Yet few classifications of intervention components exist in educational psychology, potentially exacerbating failures to replicate intervention effects (Plucker & Makel, 2021). To address this gap and facilitate implementation, reproducibility, and synthesis, in this study, we created a classification system for teachers' motivational behaviour informed by SDT.

Behavioural Classification Systems Facilitate Implementation, Reproducibility, and Synthesis

In the health domain, classification systems provide a range of benefits that we aim to reproduce in educational research. Classification systems facilitate reproducibility because they provide a reliable and clear system for identifying and describing specific intervention components (Michie et al., 2011; Teixeira et al., 2020). The most useful classification systems are developed through iterative consultation with experts (e.g., Michie et al., 2013; Teixeira et al., 2020). These consultations help craft descriptions on essential components of each behaviour while trying to avoid ambiguity and confusion. It is critical to clearly

understand interventions components so we can reliably evaluate and implement those interventions. For example, feedback is influential in health and education (Wisniewski et al., 2019), but the kind of feedback matters. Where a study authors might merely say 'participants were given feedback on their progress', health behaviour change taxonomies help distinguish between feedback on behaviours (e.g., step-count), feedback on outcomes (e.g., weight), biological feedback (e.g., heart rate), self-monitoring as a form of feedback (e.g., pedometers), and monitoring by others but without feedback (e.g., attendance data). Each of these types of feedback appears to have different effects for self-efficacy and behaviour, which often further varies depending on the population (e.g., Ashford et al., 2010; French et al., 2014). Classification systems help reproducibility because they allow researchers to describe interventions in a way that lets other researchers replicate the core components of the intervention (Michie et al., 2015; Michie, Fixsen, et al., 2009).

An obvious extension of this benefit is implementation. If researchers identify an SDT-based intervention that works, then practitioners working with teachers will need to know what core components were involved in that intervention. It is easier, for example, to implement an SDT intervention that specifically targets five behaviours from a clearly described list, than it is to implement a loosely defined SDT intervention without reference to specific behaviours. Classification systems can go into more detail about intervention components than is usually presented in research papers. Teixeira et al. (2020) identified detailed descriptions of SDT intervention components in health, and they explained how each intervention component supported each psychological need. If the same were available for education, it would help teachers to translate effective interventions into practice, particularly when they are less familiar with the details of the psychological theory. While a nuanced and sophisticated understanding of the theory would be ideal, a clear and robust translation of that theory into practice could help act as a bridge between researchers and educators.

Another benefit of behavioural taxonomies is for use in evidence synthesis, like systematic reviews and meta-analyses on the effects of SDT-based interventions. Meta-analyses in education are plagued by unexplained heterogeneity (de Boer et al., 2014). Even after controlling for many features of the intervention, some interventions work better than others. The same is true in health research, where taxonomies of behavioural components have helped to disentangle some of that heterogeneity (e.g., Ashford et al., 2010; French et al., 2014; Michie, Abraham, et al., 2009). By being able to reliably code each intervention for the techniques that they employed, researchers can meta-analytically assess whether effective interventions are more likely to use some components, compared with the ineffective interventions (Ashford et al., 2010; French et al., 2014; Michie, Abraham, et al., 2009). For example, in over 100 trials to change diet and exercise, interventions that asked participants to monitor their own behaviour were more effective than those that did not, controlling for all other intervention components (Michie, Abraham, et al., 2009).

These kinds of conclusions are difficult to assess through individual studies because that would involve randomly assigning each possible component to see the effects on its own. Such an undertaking would be expensive and complicated. Instead, a classification of motivational behaviours would allow those involved in evidence synthesis to assess whether interventions are more effective when they employ specific intervention components. By creating a detailed classification system that experts agree upon, those doing meta-analyses are more likely to include important intervention components (e.g., to assess for the provision of choices), to code components reliably (e.g., what 'choice' looks like in a classroom), and to use the same vernacular across meta-analyses (e.g., such that one review looking at 'choice' can be compared to another).

Some taxonomies of intervention components are atheoretical (Michie et al., 2013). These are useful for making data-driven decisions about what components work when

multiple theories might explain outcomes, or when theory advancement is less focal. Other classification systems are focused on a specific theory (e.g., SDT; Teixeira et al., 2020), which has a range of advantages. Most theories hypothesise a range of behaviours that lead to improvements in motivation, and a powerful test of those theories is to see whether theory-driven interventions have hypothesised outcomes (Hagger & Weed, 2019; Lazowski & Hulleman, 2016). We can become much more confident in a theory if students randomised to receive a theory-driven intervention become more motivated than those who do not, especially when effects are mediated by hypothesised mechanisms. But, to test and apply a theory via interventions, it is essential to understand how the theory links to the specific intervention components (Michie et al., 2018). Otherwise, the concordance between theory and intervention can be unclear. In health settings, 'theory-driven' interventions vary dramatically in the number of theory-adherent intervention components they use (Ntoumanis et al., 2020). Also, up to 90% of 'theory-driven' interventions do not report how each intervention component relates to the theory (Prestwich et al., 2014). We are not aware of any efforts to assess this percentage in education. This is a problem because we may be 'testing a theory' using an intervention that is weakly aligned to those theories. Hence, a classification system of theory-adherent motivational behaviours is essential for both intervention development and theoretical advancement in education. In this study, we focus on creating a classification of teacher behaviours based on SDT.

Self-Determination Theory

SDT is a theory of motivation that has been well-established in education (Reeve & Cheon, 2021; Ryan & Deci, 2020). It contains six 'mini-theories' that together propose a causal model for how teacher behaviour influences student outcomes (Ryan & Deci, 2017). Working backwards from those outcomes, students learn more, are more engaged, and enjoy school more when motivated by more autonomous forms of motivation (Taylor et al., 2014;

Vasconcellos et al., 2020). Autonomous forms of motivation are those that are more self-directed, such as learning for the inherent joy of doing an activity ("intrinsic motivation") or as a means to personally valued goals ("identified regulation"; Ryan & Deci, 2017). In contrast, students may underperform and be less happy when motivated by controlled reasons (Taylor et al., 2014; Vasconcellos et al., 2020). These forms of motivation include feelings of obligation or contingent self-worth ("introjected regulation"), and a desire to receive rewards or avoid punishment ("external regulation"; Ryan & Deci, 2017). Autonomous motivation leads to better outcomes than controlled motivation in many domains, including education. A meta-analysis of 223,209 students found autonomously motivated students are more engaged, effortful, satisfied and happy (Howard et al., 2021). They are less absent, bored, anxious, depressed, and likely to drop out of school (Howard et al., 2021). Benefits of autonomous motivation have also been shown in meta-analyses of teacher motivation (Slemp et al., 2020), leadership (Slemp et al., 2018), and health behaviour (Ng et al., 2012; Ntoumanis et al., 2020).

The benefits of autonomous motivation are so robust because those types of motivation are driven by the satisfaction of three basic psychological needs (Bureau, J et al., 2022; Ryan & Deci, 2017). According to SDT, all people have a need to feel effective (the need for competence), to feel connected to those they care about (relatedness), and to feel volition in and a self-endorsement of activities they undertake (autonomy; Ryan & Deci, 2017). Consistent with SDT, the aforementioned meta-analyses all showed that autonomous forms of motivation are more likely when these basic psychological needs are satisfied (Bureau, J et al., 2022; Ng et al., 2012; Slemp et al., 2018; Vasconcellos et al., 2020). In education, teachers who support basic psychological needs confer a range of benefits to their students (Bureau, J et al., 2022; Jang et al., 2016; Reeve & Cheon, 2021; Ryan & Deci, 2020; Taylor et al., 2014). However, thwarting basic psychological needs can contribute to a range

of negative consequences, including lower self-esteem, disengagement, and poor academic performance (Bartholomew et al., 2018; Reeve & Cheon, 2021; Ryan & Deci, 2020).

Unfortunately, many teachers exhibit controlling, cold, or chaotic teaching styles (Aelterman et al., 2019; Van den Berghe et al., 2013). Controlling styles are those where teachers pressure students to follow the teacher's commands, regardless of student preferences (thwarting autonomy; Aelterman et al., 2019). Cold teachers show little personal care or concern for their students (thwarting relatedness; Van den Berghe et al., 2013). Chaotic teaching styles leave students to lean on their own, leaving them feeling overwhelmed or confused (thwarting competence; Aelterman et al., 2019). Fortunately, teachers can learn how to avoid enacting controlling instructional behaviours that thwart students' basic psychological needs and instead adopt replacement instructional behaviours that support the three psychological needs (Reeve & Cheon, 2021; Su & Reeve, 2011). They can, for example, support autonomy by providing students with choices rather than mandates, or provide rationales rather than unjustified directives (Aelterman et al., 2019; Patall et al., 2017; Reeve & Jang, 2006). They might support relatedness by acknowledging and accepting negative affect rather than punishing it, or expressing interest in students (Patall et al., 2017; Reeve & Jang, 2006). They might support competence by providing specific, informative feedback and clear goals (Aelterman et al., 2019; Patall et al., 2017; Reeve & Jang, 2006). The goal of these interventions are to simultaneously reduce the risk that teachers thwart students' psychological needs while also increasing the chance that teachers support those needs (Reeve & Cheon, 2021; Su & Reeve, 2011). In doing so, they are likely to increase student motivation, engagement, and learning (Jang et al., 2016; Reeve & Cheon, 2021; Ryan & Deci, 2020; Taylor et al., 2014).

Although student motivation is influenced by many factors, such as the values of the student (Ryan & Deci, 2017), teacher behaviours have the highest leverage for interventions

because they have strong effects on students while also being malleable (Reeve & Cheon, 2021; Ryan & Deci, 2020; Su & Reeve, 2011). Learning how to support psychological needs can also confer a range of benefits to educators, who can also become more motivated by learning how to better motivate others (Ntoumanis et al., 2017). Reaching a consensus on the descriptions of these teacher behaviours is critical to improve how well we assess and implement SDT interventions. A robustly produced classification system could help us understand which teacher behaviours are most influential, and enable tests and translations of those behaviours in schools.

Robust Methods for Developing Behavioural Taxonomies

When researchers have developed behavioural taxonomies in the past, there have been two broad approaches. In the first, a relatively small group of experts—usually less than 10—write a paper where they list and describe the behaviours they think are relevant (e.g., Abraham & Michie, 2008; Michie et al., 2011). This may be similar to what educational researchers have been doing informally, listing the behaviours that the authorship team believes are consistent with that theory. Although this approach is efficient, more recent taxonomies have leveraged the Delphi method as a more formal and systematic means of gaining expert consensus (Hardcastle et al., 2017; Michie et al., 2013; Teixeira et al., 2020).

The Delphi method involves asking experts to iteratively and systematically answer a number of questions, ideally until they reach consensus (Brown, 1968). Between each iteration, experts see what their peers thought, and are given an opportunity to update their beliefs on the basis of those opinions (Brown, 1968). Delphi studies aim to eliminate many of the biases that often foil group decision-making processes (Powell, 2003). For example, researchers using the method tend to assemble a large number of experts (usually > 20) to more reliably leverage the 'wisdom of the crowd' while aiming to maintain high standards for panel membership (Baker et al., 2006). This larger number of experts is more likely to fully

cover the 'landscape' of perspectives on the question. Researchers using the method often de-identify the contributions of each group member so arguments are judged on their merit rather than on the personal identity of who makes the argument (Moore, 1987). They also ask for independent opinions in parallel so assessments are less likely to be clouded by the judgments of others. Applied to behavioural taxonomies, the Delphi method is likely to lead to a more reliable, clear, exhaustive, and authoritative list of behaviours than taxonomies developed by a small authorship team using ad hoc procedures (Hardcastle et al., 2017; Michie et al., 2013; Teixeira et al., 2020).

Aim of the Present Study

In this study, we used a Delphi method to create a classification of teacher behaviours consistent with SDT. As per previous Delphi studies that catalogue intervention components (Hardcastle et al., 2017; Michie et al., 2013; Teixeira et al., 2020), we first searched the literature to create an initial list of candidate behaviours. Next, we assembled a large group of researchers with expertise in SDT applied to educational settings. We then used the Delphi method to work with these experts to:

- clarify the descriptions of each behaviour,
- rate the relevance of each behaviour to SDT,
- align each behaviour to a basic psychological need, and
- estimate the average likely effect of those behaviours on student motivation.

The experts were also asked to identify redundant behaviours, and suggest missing ones. The ultimate goal of the process was to create a mutually exclusive and collectively exhaustive list of teacher behaviours that support or thwart psychological needs. In doing so, we aimed to create a classification system of motivational behaviours that researchers and practitioners could use to better implement, reproduce, and synthesise interventions for improving student motivation.

Method

Similar to the procedure in the previous classification systems, we applied a three-round Delphi procedure (Michie et al., 2013; Teixeira et al., 2020). For most questions, three rounds of the Delphi method are generally enough to reach an equilibrium where future rounds substantially do not change results (Delbecq et al., 1975). As described below, we assembled a panel of experts in SDT in education, generated an initial list of teacher behaviours, and used three Delphi rounds to refine that list.

Participants

To solicit diverse but authoritative perspectives on how teachers support and thwart students' basic psychological needs, we assembled a panel of international experts. In this study, we invited researchers if they:

- had a PhD in motivation, education, or applied psychology;
- published at least three articles focusing on SDT—at least one of which was an intervention—in peer-reviewed journals indexed in PubMed or Scopus in the preceding 5 years; and
- had at least 5 years of related experience in education as an academic or a researcher

There are no agreed-upon standards for a minimum panel size (Jorm, 2015; Powell, 2003). As per recommendations, we used existing Delphi studies that met consensus as a guide for our sample size (Jorm, 2015). Previous studies aiming to develop a classification of behaviour change techniques recruited between 10 and 18 experts (Hardcastle et al., 2017; Michie et al., 2013; Teixeira et al., 2020). To account for the potential of attrition (Donohoe & Needham, 2009), in this study we decided on a conservative number of at least 30 experts. Expert recruitment began after the first author gained clearance from their institution's human research ethics committee.

We used recent systematic reviews to collate papers using self-determination theory interventions in educational settings (Lazowski & Hulleman, 2016; Reeve & Cheon, 2021; Ryan & Deci, 2020; Vasconcellos et al., 2020). We assessed whether the corresponding author of these papers met our criteria, and if so, we invited them to participate in our study. We also asked participants to recommend other possible experts in their networks ('snowball recruitment'). Of the 138 experts approached, 34 consented to participate (41.2% female). The participating experts were researchers with expertise in designing, conducting, and evaluating SDT-based interventions in education (Mean Years of Experience = 14.97, SD = 8.88). The median *h*-index of the experts was 18.50 (mean = 31.91). These experts resided in Australia (9), USA (4), England (3), the Netherlands (3), Canada (2), China (2), Denmark (2), Estonia (2), Belgium (1), France (1), Iran (1), Norway (1), Spain (1), Switzerland (1), and Turkey (1).

Developing an Initial List of Teacher Motivational Behaviours

To develop an initial list of teacher motivational behaviours, we collated behaviours from intervention descriptions, theory papers, questionnaire items, and existing taxonomies of behaviour change interventions. We screened systematic reviews for interventions and questionnaires assessing teacher behaviours (Lazowski & Hulleman, 2016; Reeve & Cheon, 2021; Rosenzweig & Wigfield, 2016; Smith et al., 2016; Su & Reeve, 2011; Vasconcellos et al., 2020). We also reviewed theory papers (e.g., Aelterman et al., 2019; Ryan & Deci, 2017) and previously-developed behaviour change taxonomies (Hardcastle et al., 2017; Michie et al., 2013; Teixeira et al., 2020). From all these sources, we collated 1,151 behaviours that could plausibly be used by teachers that might influence student motivation. We stopped when we reached saturation, that is, when all new behaviours were subsumed by behaviours already on the list.

Naturally, this process resulted in substantial redundancy, so to create a mutually exclusive and collectively exhaustive list of behaviours we used a binning and winnowing protocol (DeWalt et al., 2007; Mâsse et al., 2016). Binning involves systematically grouping things that refer to the same latent construct (DeWalt et al., 2007). Winnowing involves reducing the contents of those bins into a representative example (DeWalt et al., 2007). Binning and winnowing has been used to create a comprehensive bank of parenting practises (Mâsse et al., 2016) and patient-reported outcomes in chronic diseases (DeWalt et al., 2007). The process generally involves three steps:

1. grouping similar behaviours into bins;
2. winnowing behaviours from bins into an exemplar of that bin; and
3. refining exemplars via iterative feedback.

For Step 1, four authors created an initial list of 48 'bins' for behaviours based on theory. Then, eight authors took the initial list of behaviours and placed them into those bins. Each behaviour was classified independently and in duplicate by two of those authors. When behaviours did not fit into an existing bin, authors created a new bin, leading to an expanded list of 61 bins. For each of those bins, two authors completed Step 2—creating an exemplar of that bin. Exemplars contained:

- a meaningful name for the behaviour (e.g., "Conditional positive regard");
- a draft description of the behaviour (e.g., "Withdrawal of warmth from a student in response to poor behaviour");
- an example of the behaviour used by a teacher (e.g., "I am sick of your behaviour"); and
- a description of the function of the behaviour in promoting or thwarting motivation (e.g., "Demonstrate that attention and warmth are contingent upon meeting the teachers expectations of good student behaviour")

This initial draft list of behaviours was then member-checked (Step 3) by the eight authors who conducted the binning, and five teachers from local secondary schools. Based on the input of these authors and teachers, two authors refined this list of behaviours before using them as the foundation of the Delphi procedure. Following this member checking, 12 motivational behaviours were added to the candidate list, meaning the Delphi procedure started with 73 possible teacher motivational behaviours.

Delphi procedures

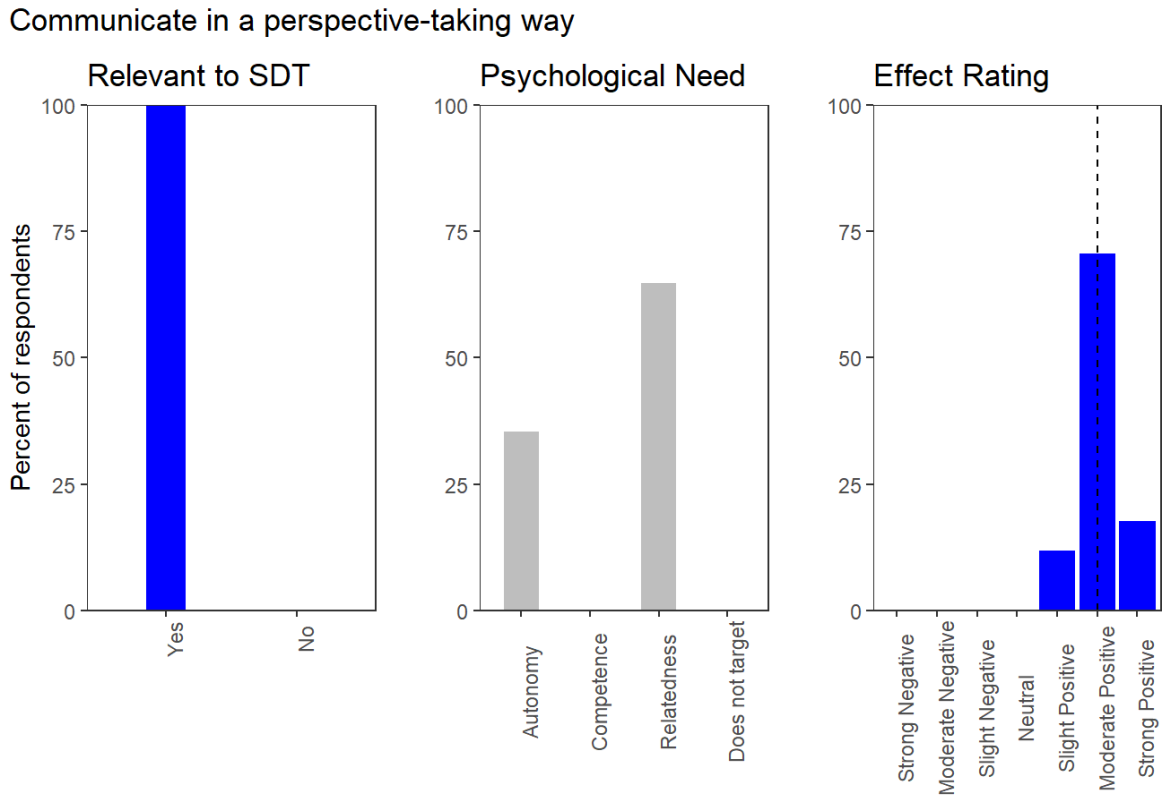
We designed and distributed the surveys online using the Research Electronic Data Capture system (REDCap; Patridge & Bardyn, 2018). In the first round, the experts provided qualitative feedback on the label name, description, example behaviour, and function description of each teacher motivational behaviour (TMB). They judged whether the behaviour was related to SDT. If their answer was yes, they identified which basic psychological need that behaviour most strongly influenced, and rated how strongly they felt the behaviour influenced motivation (7-point scale ranging from *'-3 Strong negative effect'* to *'+3 Strong positive effect'*). To help generate a mutually exclusive list of behaviours, at the end of the survey, we provided experts with a full list of TMBs and asked them to identify whether any behaviours appeared to be redundant (i.e., where two TMBs overlapped such that they described the same essential behaviour). To help generate a collectively exhaustive list, experts were also asked to nominate any other behaviours they thought were missing from the list.

After each round of the Delphi process, four authors refined the TMBs in response to the expert feedback. Where actioning recommendations involved major changes (e.g., substantially different function description), the revised TMB was considered a new behaviour, and we discarded existing ratings (e.g., of effect). In Rounds 2 and 3, we provided experts with the updated list of behaviours where ratings were available, and gave them

visual feedback of the panel's responses to the previous round via bar charts (see example in Figure 1). Visual feedback like this helps panellists quickly see the responses of the other experts so they can assess how their beliefs compare with those of the group (Ward et al., 2014). Experts could choose to use this feedback in their updated ratings or not. Below each behaviour, we asked experts to provide qualitative feedback on the behaviour's label and description, the example, and the function description. We then also asked them to rate whether the TMB was relevant to SDT, and if so, to identify the most appropriate psychological need and the anticipated effect on motivation. We also asked them to identify missing or redundant behaviours at the end of each Delphi survey. When a TMB reached consensus on all ratings and no changes were recommended, it was added to the final list of teacher behaviours and not rated again.

Figure 1

Example Feedback to Delphi Panellists Provided in Round 2 and Round 3



Note. We informed panellists that the blue colouring indicated a question that met consensus, and the dashed vertical line on the 'Effect Rating' plot indicated median response.

Consensus Criteria

There are no defined standards for consensus for all questions in Delphi studies (Keeney et al., 2006; Trevelyan & Robinson, 2015). This is because it is easier for all panellists to agree on a binary choice ('yes' vs. 'no') than for all panellists to provide exactly the same score on a 7-point scale. As a result, defining consensus criteria is an inherently subjective task and should account for the nature of the question and the response scale. A systematic review of 100 Delphi studies found that the percent agreement was the most frequently applied method to achieve consensus (25 studies), although a specific agreement threshold was defined in only half of those studies (Diamond et al., 2014). Among Delphi

studies, the consensus criteria varies from 51% (Loughlin & Moore, 1979) to 95% (Stewart et al., 1999).

In the current Delphi study, we used the percent agreement to analyze the "Relevance to SDT" and "Psychological Need" questions because they were nominal scales. We determined the cutoffs based on existing recommendations (Keeney et al., 2006; Trevelyan & Robinson, 2015) and previous similar Delphi studies (Hardcastle et al., 2017; Michie et al., 2013; Teixeira et al., 2020). For the binary question (i.e., "Is this behaviour relevant to SDT?"), we applied a conservative agreement level of 90% as the consensus criteria. For the other nominal question ("Which psychological need does this influence most?"), we used a slightly lower consensus criteria of 80% agreement because there were more response options, and only those who answered 'yes, this is relevant to SDT' were offered this question. This remains more stringent than the approach used in previous similar Delphi studies (e.g., 75%; Teixeira et al., 2020).

We used a different criterion for the question asking experts to rate the size of the anticipated effect for this behaviour. The panellists responded on a 7-point, ordinal scale ranging from *'-3 Strong negative effect'* to *'0 Neutral'* to *'+3 Strong positive effect'*. We judged the median to be an appropriate measure of central tendency. In line with the most conservative recommendations from a systematic review of Delphi studies (Diamond et al., 2014), we defined consensus as '90% of votes within one point of the median'. For example, if the median response was *'+1 Slight positive effect'* then we said the effect rating reached consensus if 90% of experts answered between *'0 Neutral* and *'+2 Moderate positive effect.'*

At the completion of the three rounds, we collated behaviours that were overlapping, which some experts had recommended for deletion. Rather than make a unilateral decision, we asked all experts to rate whether or not those behaviours should be deleted. We presented

de-identified arguments for and against deletion, if relevant, and deleted a behaviour if more than 51% of experts agreed that the behaviour should be removed.

Transparency and Openness

All the research materials and analysis code are available on the Open Science Framework (https://osf.io/apvyf/?view_only=5f7d11df23a142f58b7bf0080dad3e73). Data were analysed using R, version 4.0.3 (R Core Team, 2020) and the packages ggplot2, version 3.3.5 (Wickham, 2016), and tidyverse, version 1.3.1 (Wickham et al., 2019). This study's design and its analysis were not pre-registered. The raw data of this study are not available.

Results

Delphi Round 1 Results

Thirty-four experts completed the Delphi Round 1 survey. From the initial list of 73 teacher motivational behaviours, 21 reached consensus across all questions in Round 1 (relevance to SDT, targeted psychological need, and anticipated effect; see the Delphi Round 1 Results with plots in Supplementary File 1, also available at https://osf.io/apvyf/?view_only=5f7d11df23a142f58b7bf0080dad3e73). We applied the experts' qualitative feedback and included the 52 TMBs that did not reach consensus in the next round to be re-rated. Also, experts suggested 9 new TMBs which we added to the next survey. Also, experts substantially modified the descriptive information for 2 behaviours that reached consensus in round 1 (Allow for student input or choice, and Provide conditional positive regard). Because the modifications were substantial, we treated the behaviours as new items and asked experts to re-rate them in Round 3.

Delphi Round 2 Results

Thirty-two experts (out of 34 participating experts) completed the Round 2 survey. Of the 61 TMBs in this round, 24 TMBs reached consensus for all questions (see the Delphi Round 2 Results in Supplementary File 2, also available on the Open Science Framework at

https://osf.io/apvyf/?view_only=5f7d11df23a142f58b7bf0080dad3e73). We applied the experts' qualitative feedback and included the TMBs that did not reach consensus in the next round survey to be re-rated. We removed four TMBs after being identified by a number of authors as obviously redundant (e.g., "Unfair use of praise" was the antithesis of "Fair use of praise"). Experts suggested one new TMB which we added to the next survey.

Delphi Round 3 Results

All 34 experts completed the Round 3 survey. Of the 36 remaining TMBs, 10 reached consensus for all three questions (see the Delphi Round 3 results in Supplementary File 3, also available at https://osf.io/apvyf/?view_only=5f7d11df23a142f58b7bf0080dad3e73). Thirteen behaviours reached consensus as relevant to SDT, however, they did not reach consensus for "psychological need", "effect", or both. In this round, we also presented the TMBs that reached consensus in rounds 1 and 2, so the experts could recommend any overlapping/redundant behaviours. Twenty-two TMBs were recommended for deletion due to overlap with other TMBs. As described earlier, we asked experts to vote on whether or not these should indeed be deleted. Thirty-one experts responded (91%). Based on those votes, 17 TMBs were removed and 5 TMBs were retained (Supplementary File 4). Any other behaviours removed throughout the process are described in Supplementary File 5. The final classification consisted of 57 teacher motivational behaviours (see Table 1).

Table 1

Teacher Motivational Behaviours (TMBs) Derived Through Expert Consensus, Ordered by Psychological Need and Effect on Motivation

					Effect on motivation	
#	Teacher Behaviour	Description	Example	Function Description	Median	Mean
Autonomy supportive						
AS1	Allow for student input or choice	Create opportunities for students to meaningfully direct the activities they do in class	"Feel free to work with a friend or do it by yourself"	Allows students to choose tasks that align with their priorities and capabilities; supports the ownership of the behaviour	+2	2.32
AS2	Teach in students' preferred ways	Use knowledge gleaned about the student values and preferences to design class activities customised to them	"I know you love comics so I based today's lesson on …"	Aligns lesson activities to students intrinsic reasons for learning rather than imposing extrinsic reasons	+2	2.09
AS3	Provide rationales	Explain the reason to perform the behaviour (e.g., why an activity is important and valuable, or how it might be personally useful)	"Doing these strength exercises makes our bones stronger, giving us a healthier body"	Students understand why they are doing an activity, and ideally aligns the task to a student's values	+2	2.02
AS4	Allow student own-paced progress	Allow students to work independently and to solve a problem in their own pace	"Solve the puzzle at your own pace"	Lets students manage their own cognitive load so they do not get frustrated or overwhelmed	+2	1.91
AS5	Rely on invitational language	Instead of telling students what they must, have to, or should do, invite students to self-initiate into learning activities	"You may want to try this…" and "This behaviour has worked for students in the past who have had this same problem, would you like to try it?"	Reduces perceived external pressure to complete the task for imposed reasons and increases the sense of ownership of the behaviour	+2	1.83
AS6	Ask students about their experience of lessons	Ask students for feedback about how classes are going; could apply to either the content of lessons or the process/learning	"On these sheets, please write down what you liked about today's lesson, what you didn't like, and what was most unclear. Remember it's	Gives students a safe opportunity to suggest constructive input and shape the way classes are run, so lessons can better cater to their needs and interest	+2	1.55

#	Teacher Behaviour	Description	Example	Function Description	Effect on motivation	
					Median	Mean
		design	anonymous."			
AS7	Teaching students to set intrinsic life goals for learning	Help students link learning to other intrinsic life goals, like helping others, being healthy, embracing challenges, or improving the world	"Reading helps me to gain knowledge about life" or "I want to use my reading skills to read to little kids"	Students will try to understand the lessons more, become better at doing the activities, so that students can help others someday, or discover something interesting	+1	1.5
AS8	Provide a variety of activities	Provide a variety of activities in a way that keeps things interesting	Teacher regularly changes the format of the class (debates one lesson, worksheets the next), and presents content in dynamic ways (teaches US History using Hamilton)	Reduces boredom	+1	1.36
AS9	Provoke curiosity	Ask a curiosity-inducing question	"Why do we always see the same side of the moon?"	Piques student interest through facilitating their exploratory behaviour	+1	1.31
AS10	Discuss class values^	Collaboratively establish the values important to display in the class, or remind students of the collaboratively derived values	"We all thought helping each other was important, so if you see anyone struggling with the activities today, see if you stop to help them through the challenging parts"	Connects the activities that take place in class with values that the student cares about	+1	1.26
AS11	Provide extra resources for independent learning	Introduce extra resources for further learning or support outside of class time	"If you want more help, remember maths club before school tomorrow"; "here are some extra problems if you want to practice at home"	Allows for self-directed learning and progress outside of class time	+1	1.12
Autonomy Thwarting						
AT1	Use of pressuring language	Using pressuring or controlling language when explaining tasks, providing feedback, etc.	"You should …", "You have-to …", "You must …"	Increases perceived external pressure to complete the task for imposed reasons	-2	-2.24
AT2	Set up activities that exclude some	Set up activities so there are times where some students are	"If you have finished the questions, just sit quietly until everyone else is	Students do not have opportunities to engage even if they want to	-2	-1.82

#	Teacher Behaviour	Description	Example	Function Description	Effect on motivation	
					Median	Mean
	students	not doing anything	finished"			
AT3	Set pressuring deadlines	Allow a capped amount of time for a task, or remind students they are running out of time	"Spend 10 minutes on this worksheet; We only have a few minutes left"	Adds pressure on students to work faster and finish tasks when the teachers says to	-2	-1.53
AT4	Use praise as a contingent reward	Praise students almost exclusively when they do what they are told	Teacher says to a student "Well done!" when they do what they were told	Increases perceived external incentives for doing an activity that is favoured by a teacher	-1	-1.34
AT5	Exhibiting solutions or answers^	Give answers to problems instead of letting students figure it out	"The answer is 42"	Stifles self-directed learning and provides external locus of causality for success (i.e., from the teacher)	-1	-1.23
Competence Supportive						
CS1	Provide optimal challenge	Offer students more challenging tasks if they find it too easy, or easier tasks if they find it too difficult	"Most of you could start on question 1. If you got 100% on the homework, you can start on question 13"	Students get the right amount of challenge for them	+2	2.28
CS2	Provide specific feedback	Provide feedback that targets a specific strategy for improvement	If you keep your eye on your attacker then you can try for an intercept, but mostly focus on marking your girl	Clarifies path toward goal achievement	+2	2.26
CS3	Praise improvement or effort	Provides praise that targets the improvement or effort from the student	"I see some excellent hard work here, and some improvements over last week's work, especially in these areas ..."	Affirms students progress and improvement	+2	2.10
CS4	Provide feedback aimed at improvement or effort	Provides feedback to help a student improve or increase effort	"You have only used pythagoras theorem. If you combine these two rules, it will help get that solution"	Nurtures students' progress by providing help that moves them forward in their learning	+2	1.95
CS5	Praise specific action	Provides praise that is specific to an action or quality of the	"This answer was very good because it showed the working out in clear	Clarifies behaviours that, if repeated, lead to goal achievement	+2	1.9

#	Teacher Behaviour	Description	Example	Function Description	Effect on motivation	
					Median	Mean
		student	steps"			
CS6	Fair use of praise	Appraises a student to help him/ her improve or increase effort	Complementing all three people who completed a project in specific ways	Increases sense of efficacy	+2	1.84
CS7	Set goals based on self-referenced standards	Set up activities where each student has their own goal; ideally done subtly so no one perceives this differentiation as a form of evaluative feedback	"Try to jump further than last time"	Promotes achievable goals by calibrating them to students skill	+2	1.81
CS8	Display hope, encouragement, and optimism	Provide positive expectations for student success	"I know you can do this"	Stimulates perceived ability to meet goals	+2	1.69
CS9	Demonstrating examples	Modelling or demonstrating examples	"When throwing, see how my other hand points at the target?"	Provides template for student to follow	+2	1.68
CS10	Provide feedback in private	Provide corrective feedback in private	Provide feedback 1 on 1 with the student	Mitigates risk of feedback being ego-threatening	+2	1.64
CS11	Clarify expectations	Provide clear instructions	"Start with problems 4.1 to 4.4 then check your answers with me"	Provides structure so students know exactly what to do	+2	1.61
CS12	Display explicit guidance	Provide clear guidance, clear goal, and clear action plans	"To understand how volcanoes work, we're going to make a model. First, grab a test-tube, some vinegar, and some baking soda."	Enables students to clearly understand what is expected of their behaviour	+2	1.6
CS13	Ask questions to expand understanding	Questioning to expand understanding or thinking	"What other sports do we use these skills?"; "When might we use division in our daily lives?"	Fosters a deeper understanding of how knowledge fits together	+1	1.5
CS14	Self-monitoring of progress and effort	Facilitate monitoring of progress, skill level, or performance	"How would you rate your performance in the last three weeks?"	Provides opportunities for accurate self-reflection of effort and progress, promoting independent learning	+2	1.48
CS15	Active learning	Set up activities where all	"Complete this worksheet	Allows each student hands-on practice	+1^	1.42

#	Teacher Behaviour	Description	Example	Function Description	Effect on motivation	
					Median	Mean
		students are engaged in a learning activity	individually to figure out how heavy the Sydney Harbour Bridge is"; "Try to make a sentence using as few of these phonemes as possible"	with an activity designed to progress development of a skill		
CS16	Offering hints^	Give hints to help students along without giving them the "right answer"	"It might be easier to start with this formula"	Supports the student's own learning processes. Allows students to maintain an internal locus of causality during learning	+1	1.15
CS17	Use pupils as positive role models	Highlight some students as examples for the rest of the class to follow	"John, you commented on your code very well. Can we put it on the smartboard so your friends can see it?"	Increase self-belief through vicarious experiences of success	+1^	0.62
Competence Thwarting						
CT1	Publicly present critical feedback	Provide critical feedback in public so other students can hear	Provide critical feedback in front of the class	Increases risk of feedback being ego-threatening	-3	-2.74
CT2	Criticise a fixed quality	Provides critical feedback that targets a fixed quality	"You are not tall enough", "maths is not your strength", "you are always missing behaving, you can't control yourself"	Emphasises the importance of inherent (e.g., genetic) abilities for achieving success and insinuates that a student can not grow in their learning	-3	-2.52
CT3	Criticise losing via peer comparison	Tell students when they are not doing as well as others	"You should learn from Paula who beat the whole class"	Emphasises peer comparison for establishing a sense of competence, meaning few students experience success by being the best	-2	-2.36
CT4	Chaotic or absent teaching	Leave students without clear instructions so the class waits or is disorganised while the teacher does something else	Teacher leaves students waiting when arranging papers at front; Teacher gives up on providing feedback so checks his/her emails in class	Students do not know what they should be doing to learn and do not get any feedback or structure about how to pursue goals	-2	-2.03
CT5	Undifferentiated challenge	The same task is set for all students regardless of their level	"Try to do a lay up by using the backboard"	Given natural variation in abilities, many students may be bored and others	-2	-1.84

#	Teacher Behaviour	Description	Example	Function Description	Effect on motivation	
					Median	Mean
		of ability		overwhelmed		
CT6	Use vague criticism	Provides vague critical feedback with no instruction on how to improve	"Come on, James, you need to do better"	Creates ambiguity regarding strategies for students to increase competence	-2	-1.74
CT7	Praise winning via peer comparison	Congratulate winners so that everyone knows who did the best	"The highest score on the exam was John"	Emphasises peer comparison, facilitating incompetence in most students, while offering a few a sense of competence from being identified as the best	-2	-1.7
CT8	Set goals where students compete against each-other	Set up activities where the goal is to do better than other student	"Whoever completes these problems in the fastest time wins"	Provides extrinsic reasons for working hard and few opportunities for success (i.e., winning)	-1	-1.47
CT9	Grouping students on the basis of ability	Grouping is done publicly and students are put in groups based on their ability so that there are "top" and "bottom" groups	"If you got more than 7/10, join this group working on Set A. Less than 7: in this group, doing Set B. If you did not complete the homework, you are over here working on Set C"	Increases public signalling of student competence, and means students are comparing themselves to others of similar abilities	-1^	-1.21
Relatedness Supportive						
RS1	Show unconditional positive regard	Act warmly towards students, especially ones who are challenging or who find the course challenging	The teacher is kind even to one student who did a task incorrectly and another who did not complete the task	Ensures performance mistakes or behavioural misconduct are not met with ego-threatening behaviour	+2	2.24
RS2	Ask about students progress, welfare, and/or feelings	Show interest in how students are doing, both emotionally and in their mastery of content	"How are you finding this activity, John"	Shows care and encourages students to express themselves openly, so they connect with their teacher	+2	2.07
RS3	Expressing affection	Be warm and kind to students	"It is good to see you, Theresa!"	Students feel they are cared for	+2	2.03
RS4	Promote cooperation	Set up activities that encourage students to work together on tasks	"As a group, work together to figure out this problem"	Allows joint pursuit toward a goal and potentially provides each other with feedback on progress	+2	1.89

#	Teacher Behaviour	Description	Example	Function Description	Effect on motivation	
					Median	Mean
RS5	Teacher enthusiasm^	Present content enthusiastically to make things fun and interesting	"Now I think this next part of the lesson is really interesting!"	Models the attitude and energy that the teacher would like the students to demonstrate; shows interest in the material	+2	1.84
RS6	Show understanding of the students' point of view^	Try to understand how students see things before suggesting a new way to do things	"I can understand that there are other things you'd rather do after school"	Helps the student feel listened-to and understood	+2	1.82
RS7	Group students with similar interests^	Create groups in the class where students with similar values or interests can work together on problems	When studying geography, grouping musical students to look at a country's music, the sporty students to look at the country's sports, and other students to look at the country's key historical events.	Allows students to work with people—and on tasks—that match their interests and values	+1	1.42
Relatedness Thwarting						
RT1	Ignoring students	During times where attending to students would be appropriate (e.g., emotional distress, misbehaviour, active learning) the teacher maintains distance or does not direct attention to the student	The teacher ignores an upset student	Makes students feel they are not valued or cared for and that their efforts are not noticed	-3	-2.79
RT2	Use abusive language (content)^	Calling students by hurtful names when they misbehave	Calling a student "dummie" or "moron"	Performance mistakes and behavioural misconduct are met with competence-threatening punishment	-3	-2.76
RT3	Provide punishments unfairly	Provide punishments unfairly so students who misbehave are treated unequally	Punishing only one of two students who are speaking out of turn	Means structures are perceived as unreliable and students feel incompetent in terms of their ability to behave	-3	-2.59

#	Teacher Behaviour	Description	Example	Function Description	Effect on motivation	
					Median	Mean
RT4	Yell or use a harsh tone	Teacher yells to get control of the class	Yelling such as "HEY!"; "STOP IT!"	Creates a more emotionally unstable and unpredictable environment for students, increasing fear	-3	-2.47
RT5	Provide rewards unfairly^	Provide rewards unfairly so students who are doing equally well, get different rewards	Rewarding only one of three people who all completed a task	Students feel rewards are not predictable and teacher behaviour unjust	-2	-2.41
RT6	Be sarcastic	Use sarcastic negative phrases	"Class started 3 minutes ago. Soooo nice of you to join us" Or, "It's not like what we are learning today is important or anything"	Demonstrates contempt for students; reduces student self-esteem; diminishes the student–teacher relationship	-2	-2.16
RT7	Provide conditional positive regard^	Withdrawal warmth from a student in response to poor behaviour; provide warmth and acceptance only when teacher's expectations are met	"Good job! You did it the way I asked you!"	Demonstrate that attention and warmth are contingent upon meeting the teachers' expectations	-2^	-1.85
RT8	Apply fair punishments^	Provide punishments fairly so students who misbehave are treated equally	Sending both of two students out of class when they misbehave or break a rule	Ensures misbehaviour is consistently and reliably met with external contingencies	-1^	-0.42

Note. Labels marked with ^ were placed in their modal category (e.g., autonomy support) but 'psychological need' did not meet consensus. Effects marked with ^ represent median but did not meet consensus. Effects are rated between strong negative (-3) and strong positive (+3). Version with sort and filter functionality in Supplementary File 9 (also https://osf.io/apvyf/?view_only=5f7d11df23a142f58b7bf0080dad3e73) for readers who want to identify the most (in-)effective behaviours across psychological needs.

Discussion

In this study, we built a system for identifying and classifying SDT-based teacher motivational behaviours that influence student psychological needs. Our Delphi panel met consensus on 57 behaviours being relevant to SDT. For most behaviours, the panel reached rigorous consensus criteria for the psychological need that each behaviour targeted, the most likely effect on motivation, or both.

With this classification tool, we aimed to help the fields of education and educational psychology to reproduce, implement, and synthesise effective motivational interventions. For example, observational or experimental research could systematically assess which specific teacher behaviours have the strongest effects on student psychological needs, motivation, and engagement. Researchers who test the effects of teacher training interventions could use this classification to describe which strategies they are using or to assess and report on the fidelity and implementation of those interventions. When practitioners and policymakers implement interventions at scale, they could then refer to the classification system as a source for detailed descriptions of which behaviours were included, and why they influence psychological needs. For pre-service and in-service teachers, the classification system may be a useful guide to what 'need supportive' and 'need thwarting' teaching looks like. And, regardless of whether researchers have already described their interventions using the classification, researchers conducting evidence synthesis could assess whether these teacher behaviours systematically explain differences in outcomes. For example, conducting a moderation analysis for interventions with and without 'student input or choice' (AS1) would test SDT's hypothesis that choice is a potent strategy for improving motivation, via support for autonomy (Reeve & Cheon, 2021; Ryan & Deci, 2020).

Experts Agree on Many Influential Behaviours

We do not yet have meta-analytic assessments of the effects of each TMB, but our international panel of experts provide a number of recommendations for how to nurture student psychological needs. Most teachers would intuitively understand the destructive effects of yelling (RT4), unfair punishments (RT3), abusive language (RT2) and criticism of fixed qualities (CT2). However, experts also agreed on the benefits of many strategies that might be less common practice. For example, they agreed that moderate benefits for satisfying psychological needs could be achieved by providing students with rationales (AS3), allowing for input or choice (AS1), helping students find ways of monitoring their own progress (CS14), and by showing empathy for students' point of view (RS6). Some of these strategies are not common practice, and are amenable to change, so they would be a useful starting point for interventions (Reeve & Cheon, 2021).

Experts also agreed that a range of theoretically aligned behaviours may only have modest effects in practice. For example, experts agreed that there should be only small benefits from adding variety (AS8), offering hints instead of answers (CS16), or in grouping students with similar interests (RS7). They also agreed that there should be only slight motivational decreases for setting competitive goals (CT8) or using praise as a contingent reward (AT4). The experts' opinions may be influenced by the expectation that these behaviours may less directly target core theoretical mechanisms of SDT, or may have competing forces that attenuate their effects. For example, praise as a contingent reward may be a method of exercising teacher control, but the destructive effects of contingent rewards may be somewhat offset by the benefits of praise on competence. Stronger causal data—like meta-analyses of randomised trials—would help verify the relatively weak benefits of these discrete behaviours. Until then, people designing interventions may want to consider whether it is better to target more influential behaviours.

As would be expected, the majority of our consensus opinions align with theoretical models of SDT (e.g., Aelterman et al., 2019; Reeve & Cheon, 2021; Ryan & Deci, 2020) and supporting meta-analyses. For example, experts agreed that improvement-oriented feedback improves confidence (Wisniewski et al., 2019), that teachers' relationships with students are influential (Roorda et al., 2017), that instruction should be clear to not overwhelm students (Noetel et al., 2021), and that differentiation and scaffolding help learning (Belland et al., 2017; Smale-Jacobse et al., 2019). While many of those meta-analyses targeted learning, our experts identified each as having positive moderate effects on motivation, too. We hope the detailed list of a substantial number of effective strategies, as identified by our expert panel, helps researchers and practitioners to develop effective interventions.

Areas of Disagreement are Ripe for Future Research

It could be most useful if future related research focused on areas where experts did not reach consensus. For example, experts did not agree on the effects of some teacher behaviours, like conditional regard (RT7), fair punishments (RT8), and grouping students on the basis of ability (CT9). These behaviours are likely controversial because the functional significance of these behaviours, or their meaning to participants, may vary depending on context. Grouping on the basis of ability may facilitate differentiation (CS1), but some children might feel the grouping publicly signals that they are in the less able group, undermining competence (Saleh et al., 2005). Behaviour management may be necessary to maintain class structure (Aelterman et al., 2019), but many behaviour management strategies include fair punishments (RT8) and selective ignoring (RT7; Simonsen et al., 2008). Targeted research on these controversial areas would help researchers ascertain when these strategies work, for whom, and why. Similarly, experts did not agree on why, for example, empathy (RS6), teacher enthusiasm (RS5), and discussing class values (AS10) improved motivation. It is likely that certain teacher behaviours influence more than one psychological need, because

all the three needs are interdependent and complementary of each other (Reeve & Cheon, 2021; Ryan & Deci, 2017). For example, 'abandoning' styles of teaching are likely to thwart both relatedness and competence; 'domineering' ones would thwart competence, relatedness and autonomy (Aelterman et al., 2019). As a result, measures of satisfaction for autonomy, competence, and relatedness routinely intercorrelate, and factor analyses reveal that they often form a higher-order need satisfaction factor (Hagger et al., 2006). It is plausible that the most potent behaviours operate by satisfying more than one psychological need. While experts often agreed that one psychological need was primarily targeted by each behaviour, experimental data would help confirm those judgements. For example, longitudinal designs with mediation models could help determine whether each behaviour influences motivation by the hypothesised psychological need.

Strengths, Limitations, and Future Directions

Our study had 34 international experts participating from 15 countries with stringent inclusion criteria and high levels of panel retention. This is a larger panel than those used to develop previous classification systems (e.g., Hardcastle et al., 2017; Teixeira et al., 2020), which meant that we were more likely to fully cover the breadth of opinions and expertise in the field. Many of our experts have researched the effects of teacher motivational behaviours and student motivation across diverse samples. However, in order to maintain our high levels of panel retention while maintaining the breadth of teacher motivational behaviours, we had to make responding to our survey efficient. This meant we needed to remove context and nuance from our examples. For example, we could not ask experts whether anticipated effects would be differentiated by gender, age, level of ability or achievement, or level of socioeconomic advantage. As a result, future studies and interventions should be aware that these individual and contextual factors may moderate intervention effects. While our Delphi study presents the likely effect of TMBs on average, those moderating factors are not well

captured by our design. Similarly, some of our experts presented arguments that the consensus opinion may not have considered (e.g., on benefits of homogenous groups; Krijgsman et al., 2020) but these arguments may have been 'drowned out' by the sheer number of contrary opinions. Finally, evaluating the effect of any individual behaviour in isolation is difficult. The effect of one single need-specific TMB may be uncertain, whereas multiple TMBs may together yield a more gestalt 'motivating style'. The effect of these 'motivating styles' may be more obvious to students than the effects of any individual behaviour. Clearly, more reliable and valid effect estimates would come from evidence synthesis of teacher and student data, moderated by contextual factors. Future researchers could assess the concordance between the expert opinions here and efforts to collate the meta-analytic data for intervention effects (e.g., Hattie, 2008).

Many interventions and reviews focus on useful behaviours teachers could adopt, but one strength of this study was that we looked at both supportive *and* thwarting behaviours. While they have opposite effects on psychological needs, thwarting and supportive behaviours are not mutually exclusive in teachers, because teachers can exhibit both types of behaviours (Bartholomew et al., 2009; Haerens et al., 2015; Sheldon, 2011; Vansteenkiste & Ryan, 2013). As a result, including need thwarting behaviours may help researchers and practitioners not only identify which behaviours to promote among teachers, but also which behaviours to prevent. One limitation of our study was that we did not discriminate between 'need thwarting' and 'need indifferent' behaviours, despite recent arguments for the role of need indifferent behaviours (Bhavsar et al., 2019). Indeed, many of our 'thwarting' behaviours may be better classified as 'need indifferent': Chaotic or Absent Teaching (CT4) may not actively block students' satisfaction of needs; however, the disorganisation in the class leaves students' needs unfulfilled (Cheon et al., 2019; Huyghebaert-Zouaghi et al., 2021). Future research may benefit from separating the TMBs that actively thwart

psychological needs from those that are need indifferent. Similarly, researchers have assessed new candidate psychological needs, like variety, novelty, and safety (González-Cutre et al., 2020; Sylvester et al., 2018; Vansteenkiste et al., 2020). While most of these needs do not yet meet all the current criteria for 'basic psychological need' (Vansteenkiste et al., 2020), if the new needs are added, the classification would need to adapt, too.

To our knowledge, our classification system is the first to systematically aggregate expert opinion of influential teacher behaviours in education. By building our taxonomy on a well-established theory of motivation in education, we hope this will help researchers and practitioners test and apply that theory in schools and universities. One limitation of this approach is that our classification may neglect other intervention components that are not drawn from SDT. Intervention components from other theories (e.g., achievement goal theory; Huang, 2012) are often consistent with SDT because those interventions satisfy basic psychological needs (blinded for review). For example, growth mindsets purportedly improve engagement due to a more stable sense of competence (Sisk et al., 2018). However, not all educational psychology intervention components are clearly aligned to SDT. For example, idealised influence from transformational leadership theory was not included in our taxonomy. There are many other factors that influence educational engagement (e.g., e-learning, parenting) and other models of motivation (Lazowski & Hulleman, 2016). While our classification system is not comprehensive for all interventions in the field of education, it has been designed to cover applications of SDT to teacher behaviour, and we hope it sets a precedent for other efforts using different theoretical models. Other taxonomies may need to be developed for full coverage of the educational psychology literature.

Conclusion

In this study we developed a classification system of teacher motivational behaviours, based on SDT. We used a best-practice three-round Delphi procedure to reach consensus

from an international panel of 34 experts. The resulting classification of 57 behaviours can be used to facilitate reproducibility as it clearly describes a range of teacher behaviours commonly applied in research. The classification system facilitates application and translation by giving practitioners clear definitions of each intervention component, and estimates of how effective each component is for promoting motivation. By facilitating synthesis, reproducibility and implementation of educational psychology research, we hope this classification makes it easier for researchers to find better ways of improving student motivation, and helps practitioners apply those methods to improve student outcomes.

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