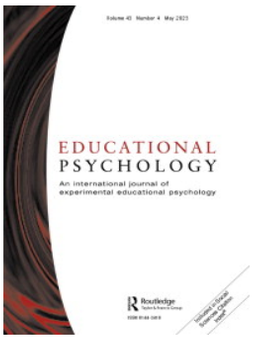

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Influence of teacher innovative behaviour on students' academic self-efficacy and intrinsic goal orientation

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ABSTRACT

Non-cognitive outcomes like Academic Self-efficacy (ASE) and Intrinsic Goal Orientation (IGO) have a bearing on students' academic and life outcomes. Yet, the way teacher practices influence these outcomes has remained underexplored. We examined the influence of Teacher Innovative Behaviour (TIB) on students' IGO and ASE within a span of one academic year (2015–16) in Indian government primary schools. Using structural equation modelling, we studied change in IGO and ASE among school students ($N = 6421$, grades 6–8) taught by 346 teachers with varying levels of TIB. The findings revealed that higher levels of TIB predicted higher levels of IGO but were unrelated to ASE after controlling for student demographics and prior outcomes. The independent variables collectively explained 20% and 15% of the variation in IGO and ASE. The implications of this study for teacher educators, education administrators, and policymakers are discussed.

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KEYWORDS
Teacher innovative behaviour; innovative work behaviour; intrinsic goal orientation; academic self-efficacy; non-cognitive outcomes

Introduction

Non-cognitive (NC) outcomes are known to predict short-term academic achievement as well as long-term life outcomes (e.g. graduation, employability, income, health) (Frank, 2020; Gabrieli et al., 2015; Moffitt et al., 2011; Rosen et al., 2010). Yet, student development strategies, especially in resource-constrained public schools in developing countries like India, do not incorporate them. In India, a 'Continuous and Comprehensive Evaluation' (CCE) scheme (2010), with its emphasis on "scholastic and co-scholastic aspects of pupil's growth" (Kothari & Thomas, 2012, p.169) was the first serious attempt to include non-cognitive aspects in schooling. However, its implementation has been affected by limited teacher-training capacity (NCTE, 2009), and the difficulty in developing easily usable indicators of non-cognitive outcomes of students.

Interestingly, despite the absence of systemic support, several public-school teachers in India have tried to improve the quality of education through practice-based innovations that targeted NC outcomes (Chand, 2012). An examination of these can

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extend our understanding of school improvement through such initiatives and help shape teacher development programs.

While several studies have examined teacher impact on student cognitive abilities (Clifton, 2013), teacher influence on students' NC outcomes remains underexplored (Blazar & Kraft, 2017). There is some literature highlighting the role of teacher innovation in developing cross-curricular skills including creativity, critical thinking, problem solving, and digital literacy (Ainley & Carstens, 2018, p.61). The link between the 'prosocial' classroom practices and students' social-emotional outcomes is also known (Jennings & Greenberg, 2009). However, the role of TIB in influencing students' NC outcomes such as intrinsic goal orientation and academic self-efficacy in a developing country context remains understudied.

Literature review

Teacher innovative behaviour (TIB)

TIB refers to 'self-initiated behaviour' involving "intentional idea generation, promotion, and realization" (Janssen, 2003; Thurlings et al., 2015). These ideas get applied "in order to benefit role performance, work group, or organization" (Klaeijsen et al., 2018). TIB derives from the broader field of 'Innovative Work Behaviour' (IWB) which is not bound by context (e.g. industrial, public sector), or roles (R&D, manufacturing). Similar predictors of individual level innovation (e.g. proactive personality), job-related factors (e.g. autonomy), and organisational factors (e.g. leadership/organisational climate) influence IWB across multiple contexts (Hammond et al., 2011).

Thurlings et al. (2015) in their comprehensive review could identify only 36 studies that examined TIB rigorously. Very few of these examined the factors influencing TIB and the effects achievable through TIB (e.g. improved problem-solving ability and time-on-task for students (Ross & Bruce, 2007), or fostering self-determination (Eisenman et al., 2005)). We could identify several studies that look at the individual level factors that influence TIB/IWB for teachers (e.g. Bawuro et al., 2019; Klaeijsen et al., 2018; Zainal & Matore, 2019) or organisational/environmental factors (e.g. Indrasari & Takwin, 2019; Johari et al., 2021; Lambriex-Schmitz et al., 2020a) but studies focused on impact of TIB/teacher's IWB on student level outcomes were absent.

In the OECD context, Ainley and Carstens (2018) present the framework used to examine innovation in the TALIS (Teaching and Learning International Study) survey. This incorporates three perspectives: teacher role in developing cross-curricular skills, teacher openness to adoption of innovation, and school contexts that foster individual and team level innovation. Chand (2012) presented case studies of 160 teachers highlighting consequences of their innovative interventions for children's non-cognitive development.

In brief, though the factors influencing TIB have been studied in recent times (Klaeijsen et al., 2018; Messmann & Mulder, 2017), the recommendation of Thurlings et al. (2015) about the need for further research on the consequences of TIB for student development, and Blazar and Kraft (2017) call for an examination of the effect of teachers on student NC outcomes remain relevant.

TIB conceptualization for present study

As noted earlier, the conceptualisation of TIB has drawn on the broader field of innovative work behaviour (IWB). The problems in IWB conceptualisation have therefore become applicable to TIB as well. Lambriex-Schmitz et al., (2020b, p.120) note that "the varying operationalization of IWB leads to contradictory results being reported in the various studies."

For the purposes of this paper, we draw on an understanding of the 'outcomes' of innovative behaviour as a proxy for teacher innovative behaviour. Thus:

> TIB is expected to result in a novel response to a problem/need; a stage of initial development by the teacher, followed by a stage of trial and monitoring (implementation); an evaluation, followed by continuation or modification; and finally, a set of results which constitute an improvement. (Chand, 2014a, p. 62).

TIB may thus result in "a classroom method, a teaching-learning aid, or an extra-school education-related action" (Hartley, 2008, p.199), which lend themselves to independent verification and assessment. These innovations are usually not 'radical' but 'incremental' adaptations of existing practices (Vieluf et al., 2012), but they involve a 'step change' from previous practice (Hartley, 2008). It is this 'step change' that results in "achievement of certain contextually-relevant educational goals" of the teacher-innovator (Chand, 2014a, p.62) concerning student outcomes. This definition involves a focus on the 'outcomes', and thus a stricter understanding of TIB; the emphasis is on the achievement of certain goals set by the teacher within her context. This addresses the concern expressed about the vagueness of the "improvement" often cited as the outcome of IWB (OECD, 2014).

A second advantage of our approach is that instead of teacher self-reports (common in TIB studies), it relies on peer-assessment of innovativeness of the work (described in detail in the methods section). Another study (Chand et al., 2021) explains how teachers in the public system who were known to be highly innovative were identified as experts and how they had assessed the innovations of their peers. This process is described later.

In this study, we examined the influence of teacher innovations on students' non-cognitive outcomes. To the best of our knowledge, this is the first study to examine the influence of teacher innovations on student NC outcomes in a large sample of students by employing quantitative methods.

TIB within context of Gujarat (India). Gujarat, a state in Western India, (60 million population) has 44,500 schools (75% public (government); 25% private). The public schools have more than 5.6 million students (84% in rural schools) and 0.2 million teachers. They face severe resource constraints. The National Achievement Survey (NAS) 2017 reported that several schools required urgent repairs (18%), additional teachers (37%), teaching materials (20%), or extra support staff (57%) (NCERT, 2017). The overall, pupil-yeacher ratio is 24 in the upper primary grades (UDISE, 2023).

Like race and ethnicity in the west, caste is an important social category in the Indian context and a basis for discrimination among social groups. The Indian constitution officially recognises three broad caste groups: Scheduled Castes (SC), Scheduled Tribes (ST), and Other Backward Classes (OBC). Anyone who does not fall into these

three categories belongs to the General (Gen) category. There are differential affirmative action (AA) provisions for people belonging to different caste groups based on the extent of disadvantage they faced historically. The caste and class intersection among Indian population results in "the [socially] disadvantaged groups [being] heavily concentrated in lower economic class category" (Nandwani, 2016, p.135). Thus, those who can afford to send their children to private schools do so, leaving government schools with children from the poorest families (Kingdon, 2017).

Students' non-cognitive outcomes

Broadly, NC outcomes include those "academically and occupationally relevant skills and traits that are not specifically intellectual or analytical in nature; a range of personality and motivational traits, habits, and attitudes that facilitate functioning well in school/life" (Rosen et al., 2010). Specific examples of these outcomes include student motivation, self-regulated learning, self-efficacy, coping and resilience (Rosen et al., 2010), conscientiousness, self-control, grit (Gabrieli et al., 2015), and work-habits, metacognitive strategies, and attitude towards learning (Farrington et al., 2012). Research links students' academic outcomes with their NC outcomes. For example, Stankov et al. (2014) found confidence to be a strong non-cognitive predictor of academic achievement. Similarly, self-efficacy in reading and writing was found to be associated with students' performance in writing tasks, a key to academic performance (Prat-Sala & Redford, 2012).

Of the several factors studied, eight have been considered amenable to development within school: motivation, academic self-efficacy, perseverance, self-control, metacognitive strategies, social competencies, resilience and coping, and creativity (Gutman & Schoon, 2013). Self-efficacy and goal orientation (both related to motivation), and metacognitive strategies have been rated to be important in raising academic learning generally and in young students specifically (Gutman & Schoon, 2013, p. 43).

Motivation theories, according to Broussard (2004), focus on three main questions: "Can I do this task? Do I want to do this task and why? And what do I have to do to succeed in performing this task?" (p.107). While the first question concerns self-efficacy and self-worth theories, the second question is driven by expectancy-value theories, intrinsic-motivation theories, and self-determination theory. The last one concerns self-regulated learning, motivation, and volition theories (Broussard, 2004).

In this article, we examine academic self-efficacy (ASE) and intrinsic goal orientation (IGO) of students, that are known to be important for children's motivation to learn and thus their academic success (Wolters et al., 1996). Further, these are pliable, and teachers and school environment can shape these (Ames, 1992; Gutman & Schoon, 2013).

Academic self-efficacy

Bandura's social cognitive theory (Bandura, 1991) posits that behaviour is motivated and regulated by external (environmental) and internal (self-generated) factors. Self-efficacy is a prominent internal factor that drives behaviour (Honicke & Broadbent,

2016). It concerns 'performance capability beliefs' of individuals based on expectations about one's own performance in a specific task (i.e. an internal mastery criterion) (Zimmerman, 2000).Since it is specific to the task, the same individual can have different SE beliefs with reference to different domains of work (e.g. academic; sports; managerial) and the perceived difficulty of the task (e.g. reading vs spelling test).

In this study, we focus on the academic self-efficacy (ASE) of students (Elias & MacDonald, 2007). In literature, ASE has been assessed using global measures (i.e. across academic behaviours) or specific measures (i.e. particular aspects of academic behaviours) (Honicke & Broadbent, 2016). Direct and indirect effects of ASE on academic performance have been established across a range of educational levels (primary level to college), student abilities (gifted students to learning disabled), and academic domains (reading, writing, science, mathematics, computer science) (Usher & Pajares, 2008; Van Dinther et al., 2011).

Intrinsic goal orientation

Learners' perceptions of the value of task, and their interest in the task and its content are captured by goal orientation . It refers to "the student's perception of the reasons why she is engaging in a learning task" (Pintrich et al., 1991, p.8).

Broadly, there are two kinds of goal orientations: mastery (tends to be linked with intrinsic) and performance (linked with extrinsic) goal orientation (Kaplan & Maehr, 2007; Pintrich, 2000). When intrinsic goal orientation (IGO) dominates, a student engages in the learning task because of the challenge, enjoyment, and curiosity offered by the task and the opportunity to gain mastery over it. With extrinsic goal orientation, the student strives for better grades, rewards and doing better than others (Pintrich et al., 1991; Zhang, 2014), or to avoid failure (Pintrich, 2000).

Mastery goal orientation accounts for about 10 to 30 percent of the variance in cognitive outcomes across age-groups and subject areas (Pintrich, 2000). In their experimental field studies, Vansteenkiste et al. (2006) found that intrinsic (contra extrinsic) goal framing resulted in higher quality learning. Youn et al. (2010) found IGO to be a significant predictor of learning outcomes in an engineering college setting. Kaplan and Maehr (2007) have also noted the promise that IGO offers in enhancing student's motivation, attitudes, and achievement.

Factors impacting ASE and IGO. Wolters et al. (2005) argue that teachers, parents, or peers can impact (facilitate/constrain) the way students regulate their own learning. ASE has been linked with teacher encouragement (Tuckman & Sexton, 1991), teaching strategies (Fencl & Scheel, 2005), teacher enthusiasm (Zhang, 2014), teachers' classroom practices (Becker, 2014), and caring teachers with a mastery-orientation (Bolshakova et al., 2011).

Similarly, teacher-dependent contextual factors like task design, instruction style, and quality of interpersonal relationships can impact students' goal orientation (Ames, 1992). Teacher enthusiasm (Patrick et al., 2000) and students' perception of 'being supported and valued by the teacher' (Wentzel, 1996) also influence IGO. Even school context has been shown to matter for students' IGO (Dowson et al., 2006). A recent study conducted in India revealed that teachers' negative behaviours are linked with

lower levels of mastery goal orientation and self-efficacy in students (Shukla et al., 2020).

These studies highlight the importance of teacher behaviour and practices for influencing students' ASE and IGO. However, to the best of our knowledge, there is no research examining the influence of teacher's innovative behaviour (TIB) on ASE and IGO.

The present study

We investigated whether teachers exhibiting higher levels of innovation were able to increase ASE and IGO of upper primary (grades five to eight) students within a span of one academic year after controlling for students' baseline ASE and IGO and student demographics, than those whose innovations were rated lower.

The student demographic variables included gender and caste membership. Caste is an important marker of social identity and social stratification in India (endnote 1; also see Ambedkar and Anand, 2014, and Shah et al., 2006). Several studies have reported gender differences in ASE (e.g. Britner & Pajares, 2001; D'Lima et al., 2014; Pajares, 2003; see Huang (2013) for a meta-analysis of gender differences in ASE). Similarly, goal orientation has also been found to be linked to gender (Koul et al., 2012; Valdés-Cuervo et al., 2015, among others).

The model used for the study is shown in Figure 1. The following research questions were examined:

1. What is the relationship between TIB and students' ASE after controlling for baseline ASE and student demographics?
2. What is the relationship between TIB and students' IGO after controlling for baseline IGO and student demographics?

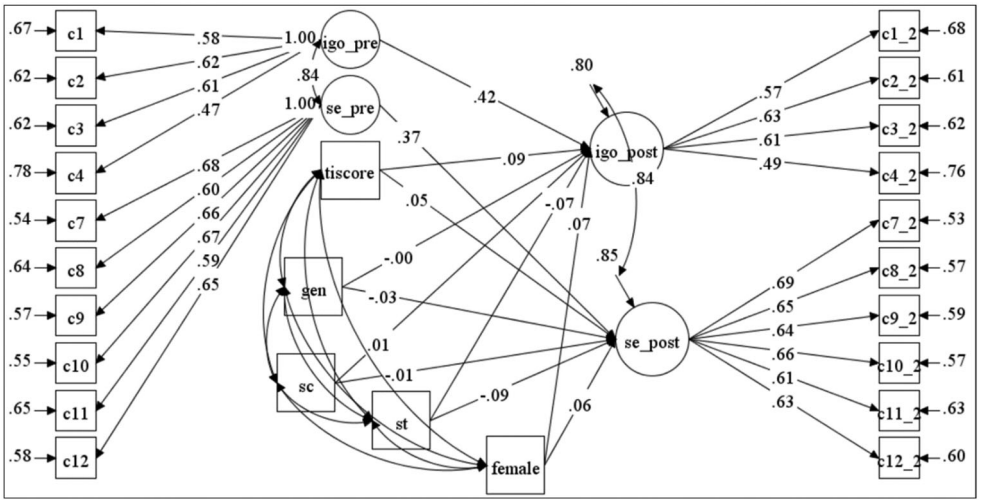

Figure 1. Structural equation model with standardised estimates.

Method

Sampling and measuring teacher innovative behaviour

The current study used secondary data from a project that is reported in Chand (2014a, 2022). This project had identified a large pool of innovative teachers in the government schooling system with the support of the provincial government. They were invited to share one innovation that was representative of their work and which they thought was "a novel and/or unique response to a problem or need; [had] a stage of initial development by the teacher, followed by a stage of trial and monitoring (implementation); [had] an evaluation, followed by continuation or modification; and finally, [showed] a set of results which constitute an improvement" (Chand, 2014a). Once the submissions were received, the nearest lower-level bureaucrats of the education department visited these teachers to verify the work and the other work done by the teacher.

The steps followed to rate the identified practices are described in Chand (2014a). In brief, out of the 10,324 submissions received, 5650 qualified as innovative according to the criteria mentioned earlier. All these practices were rated for their innovativeness by a trained eight-member team. Detailed process of the assessment validation of teacher innovation is described by Chand and colleagues (2020). The raters followed the widely used 'consensual technique' developed by Amabile (1982) (used generally for assessing creativity; adapted here for assessing innovation). They were experienced teachers well known within the state for their innovations. Amabile argued that individuals well versed with the domain within which creativity is being analysed could act as judges to rate the products as being low to high on creativity. The technique assumes that there can be no 'ultimate objective criteria' for such judgements and subjectivity of expert raters will have to be invoked in the process. The judgements on artefacts are not absolute but relative; they are not made in comparison to an external standard but only "in relation to each other" (Baer & Kaufman, 2019, p.29). This technique has been employed in diverse domains and "in domain after domain, the experts tend to agree" with very high inter-rater reliability (Baer & Kaufman, 2019, p.29), leading to the consensual technique being called the gold standard for assessment of creativity (Carson, 2006). We applied this technique to assess the innovations. This approach addresses a common criticism of the measurement of teacher innovative behaviour, namely its reliance on self-reports to infer behaviour (Thurlings et al., 2015).

The judges, all of them recognised as innovative teachers (domain experts) in an earlier study (Chand, 2012), were oriented and trained using a set of similar innovations from that study, using the following criteria, which carried equal weights: originality and novelty, match with educational needs, scope of the activity, complexity of the activity, and its spread effect. The judges had to use these five criteria to rate each innovation and then to derive a total score out of 100. They then had to discuss each work and re-examine their scores for confirmation. The mean score (from the eight ratings) gave a score of innovativeness of that innovation. Once the judges were familiar with the rating procedures and had developed a shared understanding of the process, they undertook the process of rating all innovations independently on a scale of 0–100 based on 5 dimensions mentioned earlier.

The innovations were rated on a scale of 0 to 100, indicating a range of innovativeness—from very weakly innovative to strongly innovative. The mean score (from the eight ratings) gave a score of innovativeness of that innovation. The 5650 teachers were sorted on their innovation scores, and a sample of 350 was drawn by systematic circular random sampling. Being univariate outliers on innovation score, four teachers had to be dropped.

The final sample consisted of these 346 teachers. The number of students per teacher ranged from 5 to 39 students. This distribution is not abnormal since several of the schools were in remote rural areas with small student populations. These 346 teachers taught students of grades 5–8 and stayed with their classes for one whole year. Most of them had colleagues, that is, the children were exposed to other teachers as well during the year. However, it is reasonable to assume that the effects of the co-teachers would be randomly distributed across students from different schools.

The data on IGO and ASE of all 6421 students in the classrooms of the 346 teachers were collected at the beginning and the end of the academic year (referred here as pre- and post- data respectively). A pen and paper survey was conducted in the absence of teachers by a trained survey research team. Eighteen cases had to be dropped since the survey responses were the same across all items. Thus, we removed these 18 cases and used the remaining 6403 for analysis. Only 21 values were missing (<0.001% of sample size).

The caste and gender composition and family income of the sample is given in Table 1. The sample is representative of the caste and gender composition of the government-school-student population in government schools.

Measures

Teacher innovation score

As described above, following the procedures prescribed for consensual assessment technique, the judges independently rated innovative practice of teachers first, and then the mean score on a scale of zero to 100 was derived. The scores for the 346 teachers in the sample varied from 32.5 to 94, where higher values indicated higher quality innovations.

Table 1. Caste and gender composition and family income of the sample.

	Caste				
Gender	General	SC	ST	OBC	Total
Male	288	190	561	2070	3109
Female	381	190	630	2093	3294
% of sample	10%	6%	19%	65%	100%
Monthly family income					
<3000 ($43/month)	35%	33%	58%	46%	46%
3000–6000 ($43–$85/month)	47%	45%	32%	37%	38%
>6000 (>$85/month)	18%	22%	10%	17%	16%

Note. GEN: General; SC: Scheduled Caste; ST: Scheduled Tribe; and OBC: Other Backward Classes. Conversion rate: 1US$=77.60 Indian Rupees (as on August 11, 2019).

Intrinsic goal orientation and academic self-efficacy

IGO and ASE were measured with the relevant sub-scales of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991), an 81-item self-report instrument developed to measure students' motivation orientations and use of learning strategies. Students respond to the items on a scale of 1 to 7, where 1 indicates *not at all true of me* and 7 indicates *very true of me*. Four items measure IGO, and eight items measure ASE (Appendix A). MSLQ (full questionnaire, and its subscales separately) has been validated in diverse contexts and geographies with good reliability and model fit (Artino, 2005; Chow & Chapman, 2017; Credé & Phillips, 2011; Erturan İlker et al., 2014; Taylor, 2012).

The survey instrument was translated from English to the local language (Gujarati) and back-translated into English by another translator to check for accuracy. The scale items of the translated instrument were found to be invariant across the four caste and two gender groups (Maun et al., 2020). The Cronbach Alpha values were 0.66 for IGO and 0.83 for SE scales (for both pre and post data).

Demographic variables

Along with the questionnaire, the survey form captured the student's name, grade and school details (name and location), gender (coded 1 for female, 0 for male), caste (1: others; 2:SC, 3: ST; 4: OBC), family income, and parental education. Each teacher was mapped to only one class in one school and was given a unique code (TchrCod) which acted as a clustering variable ("cluster is TchrCod" command in Mplus).

Analytical procedure

M*plus* (version 7.31) software was used to analyse the data. We analysed the hypothesised model in two steps. Initially, measurement models (MM) of ASE and IGO were tested to assess the model-fit using confirmatory factor analyses (CFA) with maximum-likelihood estimation (MLE). In the second step, we employed a comprehensive structural equation modelling (see Figure 1). The latent variables of IGO-post and ASE-post were specified as the outcomes for the predictors of teacher innovation (TI) score, IGO-pre, ASE-pre, and gender and caste dummy variables. To account for the relationship between the outcomes (IGO and ASE), they were allowed to co-vary freely in the model. The standard errors were adjusted to accommodate the nested data structure (i.e. survey questions were answered by students, who were nested within respective teacher's classes whose innovation scores were used) by using type = COMPLEX (sandwich estimator) command and specifying that cluster is TEACHERCODE in M*plus*. No two teachers from the sample belonged to the same school. Hence, nesting under a teacher was akin to nesting under the school.

Chi-square value is sensitive to sample size and for relatively large samples (>400, as explained by Kenny, 2020) has been shown to lead to rejection of good models (Bentler & Bonett, 1980; Marsh et al., 1988). Hence, relative chi-square (χ^2/degrees of freedom) is a better measure, and a value of <5 is acceptable (Wheaton et al., 1977). Relative chi square (χ^2/df), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square

Residual (SRMR) were used to gauge the model fit. Fan et al. (1999) and Hu and Bentler (1999) suggested the following cut-offs for good model fit: CFI $>$ 0.95, TLI $>$ 0.95, RMSEA $<$ 0.06, and SRMR $<$ 0.08.

The MM Included four items and eight items (observed variables) representing IGO and ASE (latent construct), respectively. The two phases of data collection for the same latent variables allowed us to perform CFA separately for pre and post data which enhanced the robustness of the results.

Results

Teacher Innovation scores varied from 32.5 to 94 on a scale of 0 to 100 (mean score 60.3) with only 23 teachers scoring above 75. The mean, standard deviation, and the inter-item correlation among the items measuring ASE and IGO are shown in Table 2.

The inter-item correlations varied from .23 to .47. The mean scores for the 12-items of the two scales varied from 5.32 to 5.84 for pre-data while they were slightly higher at 5.35 to 5.96 for post data. Full measurement invariance (configural, metric, and scalar) was established for all the items of the two scales across the four caste and two gender groups for both, pre and post data. Similarly, convergent validity was also established with both scales showing good model fit (see Maun et al., 2020, for details).

Measurement model

The factor structures for IGO and SE were examined separately by employing a two-factor CFA with maximum likelihood estimation procedure with robust standard errors (MLR). All model fit indices were well within the recommended cut off values; CFI$>$.95, TLI$>$.95, RMSEA$<$.06, and SRMR$<$.08 (Table 2). All the factor loadings were significant and varied from .48 to .62 for IGO (pre) and from .49 to .63 for IGO (post), while for SE (pre), the loadings ranged between .56 to .68 and between .58 and .68 for SE (post). The average variance extracted (AVE) values for IGO (Pre), IGO (Post), ASE (Pre) and ASE (Post) were .33, .34, .38, and .39 respectively. The composite reliability values for

Table 2. Inter-item correlation, mean, and standard deviation of scale items.

Item*	1	2	3	4	7	8	9	10	11	12
1	1.00	0.39	0.33	0.23	0.36	0.32	0.31	0.33	0.28	0.32
2	0.37	1.00	0.40	0.32	0.35	0.33	0.33	0.37	0.28	0.31
3	0.34	0.40	1.00	0.31	0.41	0.34	0.33	0.36	0.30	0.35
4	0.26	0.31	0.27	1.00	0.28	0.28	0.29	0.27	0.30	0.27
7	0.36	0.34	0.39	0.27	1.00	0.46	0.46	0.45	0.41	0.41
8	0.29	0.29	0.28	0.25	0.41	1.00	0.43	0.42	0.42	0.41
9	0.33	0.34	0.30	0.25	0.47	0.41	1.00	0.41	0.40	0.40
10	0.32	0.36	0.37	0.27	0.45	0.39	0.42	1.00	0.40	0.44
11	0.28	0.27	0.33	0.29	0.39	0.38	0.37	0.39	1.00	0.40
12	0.30	0.31	0.33	0.25	0.41	0.40	0.44	0.48	0.39	1.00
Mean (pre)	5.68	5.66	5.69	5.34	5.84	5.37	5.60	5.80	5.32	5.63
S.D. (pre)	1.79	1.78	1.70	1.84	1.64	1.76	1.61	1.63	1.77	1.65
Mean (post)	5.75	5.75	5.72	5.35	5.95	5.51	5.65	5.96	5.43	5.73
S.D. (post)	1.76	1.70	1.65	1.87	1.53	1.65	1.59	1.55	1.65	1.59

*Item 1–4: Intrinsic Goal Orientation; Item 7–12: Academic Self-efficacy.
Correlation values: Lower Diagonal: pre-data; Upper Diagonal: post-data.

the four scales were .66, .67, .83, and .84 respectively. The *R*-square values for the measurement model varied from .23 to .46 for pre-data, and from .24 to .46 for post-data.

Structural model

It was hypothesised that students' IGO (post) and ASE (post) would be predicted by teacher innovation (TI) score after controlling for students' IGO (pre), ASE (pre) and demographics. Hence, for the outcomes of IGO (post) and ASE (post), the structural model included the predictors of TI, IGO (pre), ASE (pre), and dummy variables of caste and gender (Figure 1).

The model fit statistics and the parameter estimates are shown in Table 3. The model fit indices were $\chi^2/df = 2$, $p < .001$; CFI = .98, TLI = .99, RMSEA = .01, and SRMR = .02. All these indicators (CFI, TLI, RMSEA, and SRMR) were within the recommended cut off values.

Teacher innovative behaviour, students' prior outcomes and demographics jointly explained about 19.5% and 15.1% variation in IGO and SE, respectively. As expected, SE (pre) was the strongest predictor of SE (post) with β=.37. Similarly, IGO (pre) was the strongest predictor of IGO (post) with $\beta = .42$. Both these values were significant with $p < .001$.

In terms of hypothesised relationships, controlling for SE (pre), TI score was not a significant predictor for ASE (post). Controlling for ASE (pre), the students from General Caste and Scheduled Caste did not show any significant difference in ASE (post) compared to students from Other Backward Classes, while the Scheduled Tribe students were negatively impacted with $\beta = -0.09$ ($p \leq 0.01$). Controlling for ASE (pre), the female students reported higher ASE compared to male students with $\beta = 0.06$ ($p \leq 0.01$).

Table 3. Structural model completely Standardised parameter Estimates and model fit statistics.

Intrinsic Goal Orientation (Post)			Academic Self Efficacy (Post)		
Teacher Innovation Score	0.09	**	Teacher Innovation Score	0.05	
Female	0.07	***	Female	0.06	**
General	0.00		General	−0.03	
Scheduled Caste	0.01		Scheduled Caste	−0.01	
Scheduled Tribe	−0.07	*	Scheduled Tribe	−0.09	**
Intrinsic Goal Orientation (Pre)	0.42	***	Academic Self Efficacy (Pre)	0.37	***
R^2	0.20		R^2	0.15	
Model Fit Statistics					
Chi Square	482.03				
df	256				
Chi Square/df	1.88				
p-value	<0.001				
CFI	0.99				
RMSEA	0.01				
SRMR	0.02				

Note. ***($p \leq 0.001$).
**($p \leq 0.01$).
*($p \leq 0.05$).
n.s. (not significant: $p > 0.05$); df: degrees of freedom; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual.

Controlling for IGO (pre), TI scores positively influenced IGO (post) with $\beta = .09$ ($p \leq 0.01$). Controlling for IGO (pre), the students from General Caste and Scheduled Caste did not show any significant difference in IGO (post) compared to students from Other Backward Classes, while the Scheduled Tribe students were negatively impacted with $\beta = -0.07$ ($p < 0.05$). Controlling for IGO (pre), girls reported significantly higher IGO (post) than boys ($\beta = .07$; $p \leq 0.001$).

To check the robustness of our findings, the structural model was conducted on two randomly generated sub-samples. Overall, the model fit statistics as well as the parameter estimates for both sub-samples remained similar to the full sample analysis, thus increasing our confidence in the findings.

Discussion

This study sought to explore the relationship between teacher innovative behaviour (TIB) as captured by a teacher innovation score, and academic self-efficacy (ASE) and intrinsic goal orientation (IGO) of Indian middle schoolers. The findings indicated that TIB was a significant predictor of IGO after controlling for prior IGO and student demographics. TIB, as defined earlier, subsumes within it promoting curiosity and challenging children with interesting learning tasks. Many of the teachers studied have designed a variety of learning projects that can be carried out by students on their own with very little resources (Chand, 2014b). The teachers design the activities in a manner that allows the development of non-cognitive competencies. For instance, as observed by one of us, a survey of malaria prevalence in different areas of village was used by a teacher to integrate simple statistical calculations, an understanding of public health and prevention of disease, and an approach to understanding the scientific process—all part of the school science syllabus. Along with this, motivation to do similar activities on their own was an outcome the teacher aimed for. This attention to linking tasks with their learning significance may be expected to lead to intrinsic goal orientation, which in turn, could influence academic achievement (Pintrich, 2000).

Our study revealed that after accounting for student demographics and prior outcomes, within a year, there were no significant improvements in ASE linked with TIB. Literature suggests that ASE beliefs may arise from the personal histories, especially the difficulties faced when realising past achievements (Lackaye & Margalit, 2006). These could be influenced by socio-economic deprivation and the poor functioning of the public schooling system, including the impact of teachers encountered by the student in previous years. It is likely that impact of these histories is not overcome by TIB in just one year of schooling cycle. Secondly, as Usher and Pajares (2008) have argued, ASE develops when there is a combination of a novel task and some skill development, and enactive (mastery) experiences are strong. Our findings indicate that TIB can make a beginning by influencing IGO, but for this association to translate into higher ASE beliefs, more enactive experiences over a longer time period may be required.

What is interesting, however, is the finding concerning social disadvantage and students' non-cognitive outcomes (ASE and IGO). We did not find significant difference between students belonging to general (communities not eligible for affirmative

action) and other backward classes (OBC) category on both NC outcomes. While students belonging to the scheduled castes did not differ significantly from those belonging to the OBC, ST students reported lower levels of ASE and IGO than those belonging to OBC. Perhaps the cumulative socio-economic deprivation that tribal children face and the schooling they undergo are strong reasons for their response. This finding requires further exploration. Girls reported higher ASE than boys. The connection between gender and ASE has been explored in other studies also but the results have been inconclusive (Britner & Pajares, 2001; D'Lima et al., 2014; Jamil, 2018). This again needs further exploration to assess the interaction between teacher innovative behaviour and the influence of personal histories, the difficulties in realising past achievements, and the enactive experiences of girls.

Limitations

The current study employed methodologically robust pre-post survey design for capturing the student outcomes, used the independent variable of teacher innovation from a validated performance-based evaluation, and analysed data through a comprehensive structural equation modelling technique. However, the readers should be cautious while interpreting the findings. We examined if teacher innovative behaviour influenced student non-cognitive outcomes, but the students were also taught by other teachers who were not part of our study. We assume that other teachers' effects would be randomly distributed as we could not segregate the effect of non-innovative teachers. Although we collected data at two different time intervals, the study was correlational in nature and no causal inferences can be drawn. Finally, the study was conducted in one province of western India. Some students of the participating teachers could be absent or may not have consented for study participation. These factors limit the generalisability of our findings.

Implications

World Bank (2018) draws our attention to the learning crisis that many developing countries, including India, are facing. However, as Darling-Hammond et al. (2020) note from their synthesis of findings from the science of learning and development, addressing the learning crisis would call for action on four fronts: supporting relationships and a sense of community; productive instructional strategies that support "motivation, competence, and self-directed learning"; socio-emotional learning that develops non-cognitive outcomes; and systems of student support. It is in this context that this study should be examined.

The positive association of teacher innovation with intrinsic goal orientation offers a qualified hope of improving academic outcomes through teacher innovative behaviour. But if teacher innovative behaviour is not likely to be widespread, how can macro-policy leverage the limited availability of local innovations to develop the agility and adaptation demanded of it? World Bank (2018, p. 203) recommends that macro-level institutions develop coalitions with intermediary agencies. Such coalitions are particularly useful when the purpose is to adapt local innovations for large-scale

impact. An example is provided by the collaboration between the government and an academic institution, which used selected teacher innovations for online training of school principals and teachers (Kuril, 2019). The study revealed that there was a significant difference in the outcomes for school principals when case studies of innovative teachers were utilised for their online training. In an extension of this intervention, the work of 320 innovative teachers has been adapted for an online professional development program that covers about 150,000 teachers as of 2019. This coalition not only demonstrates the value of learning from teacher-driven innovations, but also has implications for how policymakers and their institutional frameworks view reform.

In addition, we hope that our study will make teachers, teacher educators, education administrators, and policymakers aware of the role of non-cognitive outcomes like self-efficacy and goal orientation in enhancing student learning and life outcomes. Our study will hopefully encourage other researchers to focus on non-cognitive skills, which are harder to measure than cognitive abilities. Studies like ours could help inform policymakers about the impact of their policies on certain crucial non-cognitive outcomes for an all-round development of children.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix A. Description of items in the two scales used in the study

	Item-label		
Item no.	Pre-data	Post-data	
			Intrinsic Goal Orientation (4-items)
1	IGO1	IGO2-1	In a class like this, I prefer reading material that really challenges me so I can learn new things.
2	IGO2	IGO2-2	In a class like this, I prefer reading material that arouses my curiosity, even if it is difficult to learn.
3	IGO3	IGO2-3	The most satisfying thing for me in this class is trying to understand the subject as thoroughly as possible.
4	IGO4	IGO2-4	When I have the opportunity in this class, I choose assignments that I can learn from even if they don't guarantee good marks, if marks were to be awarded.
			Academic Self-efficacy (8-items)
5	SE1	SE2-1	I believe I will receive excellent marks in this class if marks were to be given.
6	SE2	SE2-2	I'm certain I can understand the most difficult course material presented in the class.
7	SE3	SE2-3	I'm confident I can understand the basic concepts taught in this class.
8	SE4	SE2-4	I'm confident I can understand the most complex material presented by the teacher.
9	SE5	SE2-5	I'm confident I can do an excellent job on the assignments and tests if they were to be given.
10	SE6	SE2-6	I expect to do well in this class.
11	SE7	SE2-7	I'm certain I can master the skills being taught in this class.
12	SE8	SE2-8	Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.