



Student perceptions of feedback in reciprocal or nonreciprocal peer tutoring or mentoring^{☆☆,☆}

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ABSTRACT

Many studies show cognitive gains from peer feedback. However, no previous study has explored reciprocal and nonreciprocal peer tutoring and mentoring, with associated implications for peer feedback. University students ($n = 446$) completed an online questionnaire at the end of their first year. Participants numbered 166 (37%), while comparison non-participants numbered 280. The questionnaire investigated social and academic integration, using elements of three published scales of known reliability and validity. Analysis focused on participants vs. non-participants, with supplementary comparison of effect sizes regarding impact of the different interventions. Results showed nonreciprocal peer tutoring better enhanced students' academic integration. However, reciprocal peer mentoring better enhanced social integration. Nonreciprocal peer mentoring better enhanced student persistence. Types of feedback between methods were explored. Overall, the type of intervention(s) recommended might be tailored to the presenting needs of each student. Informing students of the likely outcomes of different types of peer assisted learning should assist them to choose optimally effective forms for their own purposes.

1. Introduction

Peer tutoring and peer assessment have cognitive effects (e.g., Koenka et al., 2021; Yan et al., 2022), although the evidence regarding peer mentoring is less certain and social effects are seen as more important. The extent and nature of student feedback in different interactive constellations is in need of exploration. Thus, the aim of this paper is not to further research cognitive gains, but to explore student perceptions of reciprocal and nonreciprocal peer tutoring, reciprocal peer mentoring and nonreciprocal peer mentoring regarding their impact on social and academic integration. These were compared between participants and non-participants, and then the relative impact of different interventions was compared in terms of effect size, and implications for peer feedback investigated.

1.1. Definition of peer assisted learning (PAL)

The interventions listed above all come under the umbrella of Peer Assisted Learning (PAL). According to Topping and Ehly's (2001) widely quoted definition: "PAL refers to a group of strategies that involve the active and interactive mediation of learning through other learners who are not professional teachers" (p. 114). Peer-assisted learning aims at "the development of knowledge and skills through explicit active helping and supporting among status equals or matched companions, with the deliberate intent to help others with their learning goals" (Topping & Ehly, 2001, p. 114). There can also be learning benefits for the peer facilitator, as peers help one another to learn and learn themselves in the process.

Confusion between tutoring and mentoring is evident in the literature (Topping & Ehly, 1998), so here a sharp distinction is made

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between them. While peer mentoring is a people-oriented strategy (the student as person is central), peer tutoring is a task-oriented strategy (the task and learning objectives are central).

Peer tutoring involves specific role taking as tutor or tutee and is most often focused on facilitation of subject-knowledge understanding with the development of learning processes and skills. This high focus on curriculum content requires clear procedures for interaction and generic and/or specific training.

Peer mentoring by contrast is a supportive one-to-one relationship with fixed roles as mentor and mentee. It is often cross-age and usually cross-ability, although participants will have some commonality in the area of experience. It is characterised by positive role models and seeks to stimulate mentees to reach higher goals, coupled with counselling and support to deal with problems. It is often focused on groups considered at-risk.

Both peer tutoring and peer mentoring involve a great deal of feedback, two-way in the case of reciprocal methods and one-way in the case of nonreciprocal methods. Feedback is explored further in the next section, where kinds of feedback in the different methods are differentiated.

2. Literature review

2.1. Student perceptions

A number of previous studies have explored student perceptions of peer feedback. For example, Ciftci and Kocoglu (2012) used questionnaires and interviews with students who used blogs as a means of peer feedback. Overall, students were not embarrassed when providing feedback, which was easy and time-independent, and made them feel like 'real writers.' Similarly, Mellati and Khademi (2014) found that peer feedback enhanced the learning experience. Yang (2016) reported students felt peer feedback reduced their anxiety about writing. Asynchronous online feedback gave them more thinking time and raised the quality of their feedback, while the quality of face-to-face peer feedback was limited by interaction time.

2.2. Peer feedback

In Yu and Lee (2016) offered a review of peer feedback in second language writing. There was evidence from a few studies on the positive impact of peer feedback on the writing performance and text revisions of the feedback givers, but somewhat inconsistent findings. Peer feedback training improved the quality of the peer feedback. Students took different stances (interpretive, prescriptive, collaborative and authoritative stances) toward the task of giving feedback, which influenced its nature, and these were related to student motives and patterns of interaction, as were cultural differences.

Students who used Adaptive Comparative Judgement (assessment using comparisons instead of criterion scoring) enjoyed the peer feedback process more (Bartholomew et al. 2019), thought the process was easier and found the peer feedback more helpful than control group students who used paper-based feedback. Lee and Evans (2019) surveyed and interviewed students who felt overall that giving peer feedback was actually more helpful than receiving it. The cognitive pressure to develop quality feedback, coupled with the social pressure to deliver it in diplomatic ways, were both powerful. Again, online peer feedback lacked the power of immediate dialogue, but the time independence probably raised the quality of the feedback, enabling peer assessors to consult other resources to support their positive and negative comments.

Shin et al. (2021) investigated elementary student ($n = 172$) cognitive styles and feedback types in relation to teacher feedback. Students with a challenge style had higher feedback acceptance for positive feedback. Comparatively, students with a threat style benefitted more from negative feedback.

2.3. Systematic reviews and meta-analyses

There have also been systematic analyses and meta-analyses in this area. Van Popta et al. (2017) reviewed peer feedback and found that providing online peer feedback had several potential learning benefits for the provider. Saeed et al. (2018) reviewed face-to-face peer review and computer-assisted peer review of English as Second/Foreign Language writing. Thirty-seven papers were analysed. Learners' interactional feedback exchanges were then categorised as: exploratory (showing learners' reflection and interpretation of the task), (2) procedural (showing how learners handled the task of revising their texts) and (3) social (showing how learners maintained good relationships). Peer interactional feedback was affected by several factors: training, mode of peer review, type of written tasks, learners' roles in peer review activities, learners' proficiency in English, learners' gender differences, configuration of peer review dyads and context of peer review.

Thirakunkovit and Chamcharatsri (2019) found over 5000 articles but only 27 were selected, yielding 52 effect sizes. Feedback from teachers produced a larger effect size (Hedges' $g = .90$) than peer feedback (.68). However, there was a noticeable difference between peer feedback without training (.60) and peer feedback with training (.74). Based on 17 primary studies, Lv et al. (2021) conducted a meta-analysis of the effectiveness of various types of online feedback, including peer, teacher and automated feedback. Teacher feedback had the largest effect size, peers' online feedback the next largest effect size ($g = 0.78$) and online automated feedback the smallest ($g = 0.70$). Data from many universities was analysed by Zong et al. (2021). Higher achievement was related to 1) provided rather than received comments, 2) longer rather than more comments, and 3) comments perceived to be helpful for revision.

Vuogan and Li (2022) meta-analysed 26 studies and found peer feedback had a large effect on second language writing ($d = .73$), no different from teacher feedback. There were larger effect sizes when students had more time to write and when treatments were longer. Jongsma et al. (2022) meta-analysed online vs. offline feedback, considering studies making direct comparisons between the two. Online peer feedback was more effective than offline peer feedback ($g = .33$).

In summary, peer feedback was appreciated by a majority of students as it gave more thinking time and reduced anxiety and was improved by training. It tended to benefit the giver more than the receiver, although this might vary with the personality style of the individual. It could be affected by type of task, learner proficiency and gender differences. Online peer feedback might be more effective than offline. However, the present study blended online and offline feedback and did not assess proficiency for the giver or receiver of feedback. Nonetheless, light was shed on the other factors mentioned above. Now theoretical issues should be explored.

2.4. Theoretical underpinnings

According to the self-determination theory of Ryan and Deci (2000), factors that enhanced vs. undermined intrinsic motivation, self-regulation and well-being led to the postulation of three innate needs – competence, autonomy and relatedness. When these three needs were satisfied enhanced self-motivation resulted, but when they were frustrated, it led to diminished motivation and well-being. Self-determination theory focused on the social-contextual conditions that facilitated vs. forestalled natural processes of self-motivation, which led to more engagement with peer feedback. Feelings of competence needed to be coupled with feelings of autonomy if successful achievement was to be internally attributed and intrinsic motivation needed to be stronger than extrinsic. Relatedness was relevant in that secure and positive attachments promoted more exploratory behaviour. Self-regulation could consequently occur in response to external pressure or from "introjected regulation", but should hopefully lead to integrated regulation. Many of these variables could be found to operate in peer-assisted learning, especially in promoting competence, autonomy and relatedness.

Lui and Andrade (2022) examined 14 previous theoretical models and synthesised these to develop their own. Research on feedback suggested that internal factors included self-efficacy, goal orientation, mindset and task motivation. Mastery goal-oriented students tended to strive to develop competence. In contrast, performance-approach students strived for a positive outcome. Performance-avoiding students were often demotivated by the chance of a negative result. Undergraduate students with fixed mindsets (c.f. those with growth mindsets) scored lower on positive adaptive factors (self-observation, self-assertion, anticipation, sublimation and humour) and higher on negative affect-regulating factors (intellectualisation, dissociation, isolation) and defensive behaviours (complaining, rejecting, splitting, projecting). Lui and Andrade's own model focused on six prominent motivational determinants (beliefs and conceptions about assessment, self-efficacy, academic goal orientation, mindset, task value, and prior knowledge).

Similarly, Panadero and Lipnevich (2002) reviewed 14 theoretical models and offered an expanded typology of feedback into five thematic areas: descriptive, internal processing, interactional, pedagogical and students characteristics. They then came up with their own synthesis, an integrative model of feedback elements that included five elements: Message, Implementation, Student, Context, and Agents (MISCA).

In the Discussion the extent to which these models are supported by the empirical findings will be explored.

2.5. Reciprocal vs. nonreciprocal formats

Reciprocal peer feedback refers to feedback given *both ways* between two students who are in the same age range (near-peers) and skill level (for example, two first-year students of the same age doing the same task and giving each other feedback). Nonreciprocal peer feedback refers to *one-way* feedback between two students who are not in the same age range (far-peers) and/or skill level (for example, a higher year student giving feedback to a first year student).

Particularly with regard to peer tutoring, Robinson, et al. (2005) found that both same-age and cross-age peer tutoring showed consistent positive effects on academic achievement, greater self-control and on-task time and increased attendance for participating minority students. Year and course position were not the same as level of ability, so some projects were characterised as cross-ability while others were same-ability. Where the tutoring or mentoring is same-ability, opportunities arise for the role (e.g., of tutor and tutee) to reciprocate, i.e., for turns to be taken in each role (e.g., De Backer et al., 2015). Same-ability and/or same-age reciprocal PAL have the power to co-create a supportive environment, which avoids the social divisiveness caused by perceptions of ability and status, and offers a richer apprenticeship for future involvement. Same-ability reciprocal PAL, furthermore, has the potential to create feelings of safety, of a caring culture and a respectful, friendly environment (Vogelwiesche et al., 2006). In the present study we found considerable support for these findings.

However, there have been few studies of the relative efficacy of reciprocal vs. nonreciprocal PAL. In Menesses and Gresham (2009) reported on the relative efficacy of reciprocal and nonreciprocal peer tutoring in the context of mathematics instruction for 59 at-risk elementary students. Both types of tutoring produced substantially larger academic gains than the waiting-list control group. Reciprocal tutoring resulted in marginally larger academic gains, but had the advantage of social inclusion and was recommended based on the fact that it remediated twice the number of students simultaneously as compared to nonreciprocal tutoring. Again, the present study supported these findings.

Dioso-Henson (2012) reported in 2012 on reciprocal and nonreciprocal peer tutoring in the performance of college students in physics. Both types of peer tutoring produced significantly larger academic gains than traditional classroom instruction and reciprocal tutoring resulted in marginally larger academic gains than nonreciprocal. In Cho et al.

(2020), compared reciprocal and nonreciprocal tutoring in mathematics with high school students. The two methods produced no statistically significant differences in either cognitive gains or student affect toward mathematics. Both peer tutoring experiences had the potential to create intellectually safe learning environments with high student engagement. Thus, it seems that reciprocal interaction can have gains as great as nonreciprocal.

These various aspects of the research literature led to the formulation of Research Questions.

3. Research questions

The present study is set in higher education and focuses on two novel research questions:

1. According to student self-report, which of the four interventions of reciprocal or nonreciprocal, tutoring or mentoring, achieves a higher level of first-year students' social integration, academic commitment, commitment attitude and persistence, in terms of relative effect sizes?
2. How do student perceptions of the nature of feedback differ between these conditions?

4. Methodology

4.1. Research design

This study was a mixed-methods post-only comparison between an intervention group and a comparison group of non-participants. However, three whole cohorts of students were investigated, excluding students with previous experience of higher education. The participants self-selected to group and the evidence gathered was only self-report. As might be expected given the subjects studied, the vast majority of participants were female.

4.2. Sample

Participants were three cohorts of first-year students, enrolled for the first time on the first-year of a bachelor programme at the Faculty of Psychology and Educational Sciences at the Vrije Universiteit Brussels. For each cohort, online survey questionnaires were administered at the start of the second year to investigate newcomers' perceptions after one year of experience of higher education. Invitations to participate in the survey were issued to 842 students and of these 731 (87 %) students completed it. Students who had been studying for more than one year at the faculty (n = 285) were removed from the sample because they had more experience of university life. Thus, a sample size of 446 (61 %) resulted. Of these, 166 (37 %) took part in PAL, 280 (63 %) did not. The students' demographic information is given in Table 1 (age, gender, discipline, year of access, participation in: nonreciprocal peer mentoring, nonreciprocal peer tutoring, reciprocal peer mentoring and reciprocal peer tutoring).

Recruitment of respondents was by required online survey assignments that were delivered to all students and collected online via Qualtrics software. All students were invited, but not all immediately complied. After three weeks, the non-complying students received a reminder. Those who did not fill in the survey were further personally reminded about it after six weeks. By these means all students eventually complied. Informed consent for using their data for research purposes was obtained from all students.

4.3. Interventions

PAL interventions took place in the informal learning contexts of the university. All incoming first-year students were eligible to attend PAL and it was highly recommended. Activities focused on fostering

Table 1
Demographic information on participants (N = 446).

Variable	Demographic category	N	%
Gender	Female	360	81
	Male	86	19
Age (years)	< 25	151	34
	26–29	250	56
	> 30	45	10
Discipline	Psychology	330	74
	Education	196	26
Year of entry to university (data gathered at start of ensuing year)	2012–2013	185	41
	2013–2014	149	33
	2014–2015	112	25
Peer assisted learning participation	Yes	166	37
	No	280	63
Reciprocal peer mentoring participation	Yes	117	26
	No	329	74
Reciprocal peer tutoring participation	Yes	41	9
	No	405	91
Nonreciprocal peer mentoring participation	Yes	95	21
	No	351	79
Nonreciprocal peer tutoring participation	Yes	30	7
	No	416	93

students' level of engagement with academic and social concerns and providing them with appropriate support structures. During a complete semester, interventions were carried out in face-to-face situations, within or outside of the campus. Four types of conditions or contact constellations distinguished these interventions from each other: (1) Reciprocal peer mentoring; (2) Nonreciprocal peer mentoring; (3) Reciprocal peer tutoring; (4) Nonreciprocal peer tutoring.

4.3.1. Reciprocal peer mentoring

This was same-age, same-ability and reciprocal. In the week before the academic year started, students were given a student buddy or peer mentor. During the following six weeks of the first semester, students supported, guided and coached each other in face-to-face, informal contexts, within and outside of campus. There was a cluster of introduction activities including a two-day welcome activity before the beginning of the academic year, six meetings (each lasting 60 min) and social events such as breakfasts, lunches and dinners. Each student was both mentor and mentee, but in different configurations and relationships, so two students were not mentoring each other – Student A was the mentor of Student B (mentee), Student B was the mentor of student C (mentee), Student C was the mentor of Student A and so on. The meeting groups (which included five to seven interconnected pairs of mentors/mentees) were additionally facilitated and coached by a team of three senior student mentors. At the end of each session, one-minute evaluations were used.

4.3.2. Nonreciprocal peer mentoring

This was cross-age, cross-ability and in a one-to-one format. From the fourth week in the first semester, students could match up with a higher year student mentor. Speed dating activities were organised that provided students with the opportunity to connect with a senior student and choose who they wanted as mentor. After each speed dating activity, a variety of games and walks were organised in order to deepen these first contacts and build up relationships. Peer mentors played an active role in these activities, assisting the new students in their transition into the university environment. The mentors' responsibility was sharply focussed on supportive, informal guidance and participation in social and extra-curricular activities. This was intended to enhance social integration between students of the same faculty and year of study. Events added to the scheme in the second semester included social events such as class weekends, dinners and attending speaker events by alumni.

4.3.3. Reciprocal peer tutoring

This was same-age and same-ability. Reciprocal peer tutoring stimulated and assisted students in mastering their subject content while integrating discipline-specific learning skills. In the past it had been targeted on at-risk subjects with historically high failure rates or those perceived as “difficult” by student participants. However, now reciprocal peer tutoring offered support to all students, regardless of their socioeconomic status, previous education or entry-level knowledge. It was not integrated within the existing teaching structure of the classes. Thus, peer facilitators formed no partnership with existing academic instructors. This is because these peer facilitators were not expected to further consolidate the information covered in traditional educational environments such as lectures or tutorials.

4.3.4. Nonreciprocal peer tutoring

This was cross-age, cross-ability and in a one-to-one format. In nonreciprocal peer tutoring sessions, participating students were provided with a detailed explanation of the academic system, resources and expectations and why these were important for the students' education and achievement. Events included academic support activities such as working with learning platforms, the library and writing academic papers. The peer tutors were intended to play an active role in these activities, assisting the new students as they adjusted to their university environment.

Further details of these interventions will be found in [Appendix 1](#). In general, the launch of the peer assisted learning systems proceeded sequentially, but some took place simultaneously. In the week before the academic year started, the reciprocal peer mentoring intervention took place, followed by the nonreciprocal peer mentoring intervention from the fourth week in the first semester. After the second month, the reciprocal peer tutoring intervention took place and was followed by the nonreciprocal peer tutoring intervention. Within these constraints, students self-selected to participate or not. The study took place over three years, with data gathered on three occasions at the start of each succeeding year. Students dropping out of peer assisted learning altogether were recorded as self-selecting to disengage, but there were few of these.

4.4. Instruments

An online questionnaire was constructed. The instrument included measures of these dependent variables: social integration (social adjustment and engagement), academic commitment (academic engagement), commitment attitude and persistence. Social adjustment was defined as the degree to which an individual engaged in competent social behaviour and adapted to the immediate social context. Social engagement referred to the *extent* and *intensity* with which students participated in and applied themselves to social activities. Academic involvement was defined as the extent to which students participated in their daily academic activities, such as attending lectures, submitting assignments and following teacher instruction in class. Academic engagement, on the other hand, referred to the *extent* and *intensity* with which students participated in and applied themselves to learning.

Items were drawn from three reliable instruments: the Social Adjustment subscale of the student Adaptation to College Questionnaire (Baker & Siryk, 1984), the commitment subscale of the Revised Academic Hardiness Scale (Benishek et al., 2005) and the Commitment Attitude Scale (Solinger et al., 2013, 2015). Questions such as these were selected for inclusion: Social Adjustment - “I feel well adapted and incorporated into the university environment”; Social Engagement - “In university I meet so many people and I make many friends”; Academic Engagement - “I keep up with my lessons well”; and Commitment Attitude - “What do I feel about my study programme? I am proud.” Each question offered a five or seven-point Likert scale for response, on a continuum ranging from 1 (does not apply to me at all) to 7 (applies to

me very well). Further details of the questionnaire items are given in abbreviated form in Appendix 2. There were also some open-ended questions in each section inviting free comments.

The reliability within this study for each variable investigated is given below (Cronbach’s Alpha): Social Adjustment 0.90 (n = 446), Social Engagement 0.83 (n = 446), Academic Engagement 0.89 (n = 446) and Commitment Attitude 0.78 (n = 446). The fourth dependent variable, persistence, was investigated by assessing students’ motivation to stay, asking whether or not they had thought of remaining at university. Student withdrawal was investigated by assessing students’ intention to leave, asking whether they had thought of leaving university or thought to stay at university. These questions were extracted from the institutional adjustment subscale of the Adaptation to College Questionnaire (Baker & Siryk, 1984), similarly based on a Likert scale from ‘not at all’ to ‘a lot’.

The developed form of the questionnaire was pilot tested with eight undergraduates, who examined it for appropriateness of the questions, clarity, language stability and wording. Minor discrepancies were found and minor vocabulary adaptations made. Additionally, a panel of researchers who were familiar with the literature and the research area examined the scales and suggested improvements. Comparison of the Dutch and English versions helped to suggest changes to the Dutch version to be closer to the psychological significance of the English version.

4.5. Data analysis

Quantitative data were analysed statistically using SPSS (Statistical Package for the Social Sciences), v. 24, comparing participants with non-participants for each intervention. The data met the t-test requirements of measured values in a ratio or interval scale, appropriate sample size, normal distribution of data and homogeneity of variance, but not that of random extraction given that groups were self-selecting. Independent samples t-tests were then used to compare the variables between the two groups (those who participated and those who did not) on: social integration, academic commitment, commitment attitude and persistence. Effect sizes were calculated (Cohen’s d), and occasionally described as “modest” (small to moderate) or “substantial” (moderate to large).

5. Results

5.1. Overall impact

Social integration. On average, participants showed a significantly higher level of social adjustment and social engagement than non-participants (social adjustment $t = -2.59$, $df = 425$, $p < 0.010$, Effect Size [ES] = .255; social engagement: $t = -2.32$, $df = 425$, $p < 0.021$, ES = .227) (see Table 2). These differences were significant in both cases.

Academic commitment. There was no significant difference between non-participant and participant groups in either academic engagement

($t = -1.12$, $df=425$, $p = .262$, ES = .117) or in academic commitment ($t = 0.66$, $df=425$, $p = .507$, ES = .063).

Commitment attitude. On average, participants showed a significantly higher mean level of commitment attitude than non-participants ($t = -5.34$, $df = 423$, $p < 0.001$, ES = .537) and this was the largest difference of all the variables.

Persistence. Participants showed a significantly higher level of no intention to leave and a higher level of motivation to stay than non-participants ($t = -5.34$, $df = 423$, $p < 0.010$, ES = .200; $t = -2.67$, $df = 383$, $p < 0.010$, ES = .264).

5.2. Impact of peer assisted learning interventions

In terms of effect sizes, both nonreciprocal and reciprocal peer mentoring participants showed a significantly higher level of social adjustment and social engagement than nonreciprocal or reciprocal peer tutoring participants (see Table 3). For reciprocal peer mentoring, social adjustment: $t = -3.80$, $df = 425$, $p < 0.001$, ES = .424; social engagement: $t = -2.73$, $df = 425$, $p = 0.007$, ES = .310. For nonreciprocal peer mentoring, social adjustment: $t = -3.16$, $df = 425$, $p = 0.002$, ES = .365; social engagement: $t = -2.66$, $df = 425$, $p = 0.008$, ES = .308).

Participants in reciprocal peer mentoring showed a significantly higher level of academic engagement than non-participants ($t = -2.74$, $df = 425$, $p = 0.006$, ES = .301) (see Table 4). The participant/non-participant difference in academic engagement was also significant for nonreciprocal peer mentoring ($t = -2.09$, $df = 425$, $p = 0.037$, ES = .409). Otherwise, academic involvement showed no significant differences. Nonetheless, in terms of Effect Sizes, participants in nonreciprocal peer tutoring showed the highest level of both academic engagement and academic involvement.

Turning to the effects on commitment attitude across participation conditions, differences between participants and non-participants in the mean ratings of commitment attitudes were significant for all interventions (see Table 5). All four interventions had positive and significant effects, with both types of peer mentoring showing substantial effect sizes (.628,.501), while both types of peer tutoring showed still substantial effect sizes (.356,.603).

Table 6 shows that differences between participants and non-participants for Intention To Leave and Motivation To Stay were generally small, except that nonreciprocal peer mentoring showed a significant effect on motivation to stay (but with a small ES, only .060).

5.3. Perceptions of feedback across methods

The perceptions of the students about the advantages and disadvantages of feedback across methods were drawn from their open-ended questionnaire responses. What follows summarises the main themes that emerged.

Table 2
Descriptive and inferential statistics for non-participation and non-participants.

Condition	Non-participants (n = 279)		Participants (n = 165)		t	df	p	d
	M	SD	M	SD				
Social adjustment	4.72	1.09	5.01	1.18	-2.59	425	** .010	.255
Social engagement	4.71	1.05	4.95	1.06	-2.32	425	* .021	.227
Academic engagement	4.58	1.07	4.71	1.15	-1.12	425	.262	.117
Academic involvement	4.33	1.27	4.25	1.26	0.66	425	.507	.063
Commitment attitude	4.82	1.02	5.35	0.95	-5.34	423	*** < .001	.537
Intention to leave	5.42	1.56	5.72	1.44	-2.00	429	* .046	.200
Motivation to stay	5.35	1.53	5.72	1.26	-2.67	383	** .008	.264

*** Effect is significant at the 0.001 level (2-tailed) $p \leq .001$, ** effect is significant at the 0.01 level (2-tailed) $p \leq .01$, * effect is significant at the 0.5 level (2-tailed) $p \leq .05$.

Table 3
Social adjustment and social engagement between reciprocal and nonreciprocal groups.

Condition		Non-participants (n = 279)		Participants (n = 165)		t	df	p	d
		M	SD	M	SD				
Reciprocal Peer Mentoring	Social Adjustment	4.71	1.13	5.17	1.04	-3.80	425	***< .001	.424
	Social Engagement	4.71	1.07	5.03	0.99	-2.73	425	** .007	.310
Non reciprocal Peer Mentoring	Social Adjustment	4.74	1.09	5.16	1.21	-3.16	425	** .002	.365
	Social Engagement	4.73	1.03	5.06	1.11	-2.66	425	** .008	.308
Reciprocal Peer Tutoring	Social Adjustment	4.80	1.12	5.11	1.15	-1.64	425	.101	.273
	Social Engagement	4.78	1.07	5.00	0.94	-1.28	425	.201	.218
Non reciprocal Peer Tutoring	Social Adjustment	4.82	1.12	4.98	1.26	-0.76	425	.450	.134
	Social Engagement	4.78	1.05	4.97	1.14	-0.92	425	.356	.173

Table 4
Academic engagement and involvement participants and non-participants in reciprocal and nonreciprocal groups.

Condition		Non-Participants (n = 279)		Participants (n = 165)		t	df	p	d
		M	SD	M	SD				
Reciprocal Peer Mentoring	Academic engagement	4.54	1.09	4.87	1.10	-2.74	425	** .006	.301
	Academic involvement	4.27	1.28	4.38	1.24	-0.81	425	.417	.167
Non reciprocal Peer Mentoring	Academic engagement	4.63	1.09	4.64	1.17	-0.10	425	.922	.009
	Academic involvement	4.31	1.27	4.23	1.26	-0.60	425	.550	.063
Reciprocal Peer Tutoring	Academic engagement	4.62	1.10	4.76	1.17	-0.78	425	.438	.123
	Academic involvement	4.32	1.27	4.15	1.26	0.82	425	.413	.134
Non reciprocal Peer Tutoring	Academic engagement	4.60	1.11	5.03	0.99	-2.09	425	* .037	.409
	Academic involvement	4.29	1.28	4.50	1.10	-0.90	425	.372	.176

Table 5
Commitment attitude: variation between participants and non-participants in reciprocal and nonreciprocal conditions.

	Non-participants (n = 279)		Participants (n = 165)		t	df	p	d
	M	SD	M	SD				
Reciprocal Peer Mentoring	4.85	1.02	5.46	0.92	-5.60	423	***< .001	.628
Nonreciprocal Peer Mentoring	4.93	1.03	5.36	0.94	-3.59	423	***< .001	.501
Reciprocal Peer Tutoring	4.98	1.03	5.34	0.99	-2.11	423	.035*	.356
Nonreciprocal Peer Tutoring	5.99	1.03	5.41	0.89	-2.17	423	.031*	.603

Table 6
Intention to leave (ITL) and motivation to stay (MTS): variation between participants and non-participants in reciprocal and nonreciprocal conditions.

Condition		Non-participants (n = 279)		Participants (n = 165)		t	df	p	d
		M	SD	M	SD				
Reciprocal Peer Mentoring	Intention To Leave	5.47	1.56	5.69	1.38	-1.38	228	.168	.149
	Motivation To Stay	5.42	1.49	5.67	1.30	-1.57	429	.118	.168
Non reciprocal Peer Mentoring	Intention To Leave	5.50	1.51	5.66	1.55	-0.89	429	.375	.105
	Motivation To Stay	5.71	1.52	5.79	1.08	-2.70	193	** .008	.060
Reciprocal Peer Tutoring	Intention To Leave	5.55	1.52	5.32	1.52	0.94	429	.348	.151
	Motivation To Stay	5.48	1.47	5.59	1.20	-0.45	429	.656	.082
Non reciprocal Peer Tutoring	Intention To Leave	5.52	1.53	5.63	1.33	-0.39	429	.697	.077
	Motivation To Stay	5.49	1.46	5.53	1.14	-0.17	429	.863	.030

5.3.1. Nonreciprocal peer feedback

Nonreciprocal peer feedback was felt to lead to more diversity in the feedback given, in that feedback from someone outside the immediate age range or skill level could provide new perspectives and insights. It could also expose students to the experiences and perspectives of older students, which could help develop a deeper understanding of their field

and improve their academic engagement. Individual quotations from students spoke to these issues:

“In the beginning, you have no structure or vision as to how to approach it and study for your exams. In the end, you could be

studying completely wrong – in too much detail, or studying unimportant content, which makes you feel completely stressed”.

“I went to them with the dumbest questions: you could ask them about really everything”.

“I was not able to see my way out of the exams, and then I had the feeling that I was supported (by the mentors)”.

“She (mentor) always asked whether I had any questions. Before the exams, she gave me personal tips for each exam. That was very helpful.”

All of this could reduce the mentees’ anxiety and sense of competition with their age peers.

“I remember I had no confidence and I did not know how the system works”.

“She (mentor) helped me know the area and have some friends. I felt more at ease. I was not stressed. She made me feel at home.”

“(After mentoring) you’ll feel much more confident. When you know what to do and how to do it. Otherwise, you are on your own.”

The continuity of mentor engagement was also a positive feature:

“It was good that they (mentors) continuously communicated, and provided sessions that stimulated us to keep up regular behaviours. Because, if they only tell students at the beginning of the year to be busy and do not repeat it, then you end up not doing it at all”.

This could inspire students to develop their own career path and feel more involved in their education and increase their academic engagement. It also helped develop a sense of belonging and inspiration. Nonreciprocal peer feedback could also promote a sense of connection between students, helping younger students feel they were part of a bigger picture, including a group of older students. The frequency of response was greater than might be expected from a teacher:

“She (mentor) regularly asked how I felt and how I was getting on with studying. Before the examinations, she sent text messages to wish me luck. After each exam, she came to me and asked how it was going.”

The speed of response was also faster than what one might expect from a teacher.

“It’s very convenient to have contact with her (mentor) through Facebook. You can just send messages and she answers very quickly”.

Broader comments included:

“Other universities do not offer a support network of senior students or a mentor scheme. This was and is very important for me”.

On the other hand, nonreciprocal peer feedback could be perceived as more distant and less personal. So the ensuing bond would be less intense, with implications for social integration.

5.3.2. Reciprocal peer feedback

Reciprocal peer feedback could encourage students to collaborate and support each other. This could lead to a sense of togetherness and team spirit between students, which could contribute to a positive group climate and social integration.

Individual quotations from students spoke to these issues:

“It was the common absence of pre-existing skills and knowledge that created the sense of safety needed to start a conversation, to help each other, and to work together.”

“You had your own Facebook page and there were always interactions of students who had done some statistics exercises. Even if you didn’t have a question, you were able to read answers to the

questions of other people. So basically, you felt that you were together during the exams. That was very positive!”.

“Social contacts and friendships increased my efforts to get more things done and increased my sense of belonging to my programme of study. Once I’d made some friends, I experienced more happiness. When you feel alone, you do not feel comfortable and your life is unpleasant. I think this has a significant negative influence on how you experience your university time and how much effort you put into your studies.”

It could also help students build confidence in their own ability to help others and provide feedback.

“When you enter university, you hardly know anybody. So, I had just arrived and in no time at all everybody was helping each other. This enabled us to experience positive interactions with classmates and build up relationships into sustainable potential friendships.”

“It’s about the people within your group, that they accept you; that you feel welcome within the group and with them; that you think together”.

“During the exams, if I had a stressful moment, I could always call her or send text messages, and ask for example ‘What is important?’”.

This could contribute to positive self-esteem and personal growth, which in turn could contribute to social integration. It could also promote the development of empathy and understanding between students, as they learned to put themselves in the position of their fellow students and provide feedback that focused on the needs of the other. Thus, it could lead to a greater sense of commonality between students, as they all faced the same challenges and obstacles in their learning process. These common goals could form the basis for long-term relationships between students. It could create a sense of reciprocity between students as they gave and received feedback from each other. This led to a positive group climate in which students felt supported and motivated to work together. It also led to students getting to know each other and connecting with fellow students with similar interests and backgrounds.

On the other hand, reciprocal feedback was sometimes more focused on improving the performance of the feedback giver, which could lead to less in-depth feedback for the receiver. It helped to improve the feedback provider’s communication skills because it forced the provider to focus on formulating clear and constructive feedback that was effectively communicated to the recipient. Better and more communication with other students were likely to lead to enhanced social integration. It could lead to a sense of competition between students, which could increase anxiety and stress and result in less effective feedback, with a negative effect on academic engagement. However, it could also reduce fear of competition, making students more comfortable and open to feedback.

6. Discussion

While the inferential statistical analysis examined differences between participants and non-participants, the comparisons between interventions was in terms of relative Effect Size. The relatively innovative intervention of reciprocal same-year peer mentoring demonstrated the largest impact on social integration, academic commitment and commitment attitude. Perhaps learners in same-level formats can be more open and inquisitive with one another, which stimulates critical cognitive conflict (Ladyshewsky, 2006; Ning & Downing, 2010). The effectiveness of reciprocal peer mentoring may be related to the benefits and satisfaction of working in a cooperative manner with peers to attain common goals. When students can contribute their own knowledge and also benefit from one another (Dion et al., 2007), they might be more socially engaged and more socially motivated to connect with other peers.

The data also suggested that nonreciprocal peer mentoring was an effective strategy for enhancing social integration. This is in line with the

findings of Bullen et al. (2010), Collings et al. (2015), Lee et al. (2010) and Sanchez et al. (2006). It provides a stable group of fellow students with whom to interact (Bozeman & Feeney, 2007) and, for some, to allow new personal friendships and collegial peer relationships to develop (Arendale, 2014). This may be related to opportunities for students to discuss topics emerging from personal and social interests in a non-threatening environment (Daloz & Holt, 1988), rather than topics emerging from the curriculum.

There was little difference in terms of Effect Size between nonreciprocal peer tutoring and reciprocal peer tutoring. This contrasts with the findings of Dobbie and Joyce (2009), Smith et al. (2007), Stigmar (2016) and van der Meer and Scott (2009, 2013). One possible reason why both showed no significant impact on social integration could be the time conditions in which the interventions took place. Nonreciprocal peer mentoring and reciprocal peer mentoring started within the first month, whereas nonreciprocal peer tutoring and reciprocal peer tutoring started around the sixth week of the first semester in the academic year, by which time bonding might already have occurred.

However, peer tutoring had an impact on academic commitment. Reciprocal peer tutoring and nonreciprocal peer tutoring students reported a stronger level of academic commitment than other students in terms of effect size. This demonstrated that student-run peer tutoring might be an effective strategy for enhancing academic commitment, in line with Hammond et al. (2010) and Sim and Koh (2003), who suggested that highly structured tutoring driven by the institution may not be optimally effective.

However, in terms of effect size, reciprocal peer tutoring had weaker effects than nonreciprocal peer tutoring with regard to academic commitment. One reason why nonreciprocal peer tutoring had more impact than reciprocal peer tutoring can be found in differences related to the programme organisation of the meetings. In particular, the literature shows that how meetings are structured is a crucial component for students' academic commitment (Pascarella & Terenzini 2005; Wentzel, 1998). Although all peer assisted learning strategies provide a relatively structured environment for students who are committed to academic success, in which they can encourage and support one another (Arendale, 2014), our reciprocal peer tutoring sessions were based on students' advice and came out of sessions which were not pre-scheduled. However, nonreciprocal peer tutoring sessions came out of both planned and unplanned sessions; this might explain the greater effects.

In terms of relative Effect Sizes, reciprocal peer mentoring was a more effective strategy for enhancing academic commitment than peer tutoring. One possible reason for this was in the limitations of self-selection. Some researchers believe that the least able students – who need help the most – are the least likely to ask for it (Martin & Arendale, 1992) and thus least likely to participate. On the other hand, as pointed out by other researchers (Kommalage & Thabrew, 2011), optional study groups like reciprocal peer tutoring often consist of students with similar knowledge, values and backgrounds - and this can limit learning opportunities for other participating students.

So, in terms of Effect Size, which intervention was most effective in improving persistence? Nonreciprocal peer mentoring was the most effective approach in impacting student persistence. The impact can be explained through in terms of cross-year personal relationships (Hall & Jaugietis, 2010). Peer mentors were higher-year students who had been at the same learning stage relatively recently and who could relate to their mentees' problems (Amaral & Vala, 2009; Grabowski et al., 2008) and had greater experience and understanding of the typical struggles (Glynn et al., 2006; Lockspeiser et al., 2008; Weidner & Popp, 2007; Weyrich et al., 2008), as well as serving as role models for first year students.

Furthermore, nonreciprocal peer mentoring as a 'transition' practice (as compared to reciprocal peer mentoring as a 'socialisation' practice) demonstrated the highest impact in terms of effect size on motivation to stay. The one-to-one and cross-age/ability format might be salient here. Moreover, higher-year students could reassure newcomers that feelings such as stress, anxiety or isolation were normal. Some researchers refer

to the tangled dynamics of the academic and social spheres, and believe that those who ask for academic and learning support are the ones who are the most socialised, are already familiar and therefore need less stimulation from others to persevere; while peer mentoring, by contrast, can make a greater contribution to those aspects of student life.

Nonreciprocal peer feedback had greater diversity and exposure to older role models, which reduced student anxiety and competition with peers and increased academic engagement. It fostered a sense of belonging and improved connection between students. Reciprocal peer feedback encouraged student collaboration and support, togetherness and team spirit, a positive group climate and social integration. It developed confidence in ability to help others and provide feedback and enhanced self-esteem. It developed empathy between students and could form the basis for long-term relationships. It helped improve the feedback provider's communication skills, because it forced the provider to focus on formulating clear and constructive feedback that was effectively communicated to the recipient.

6.1. Relationship to theoretical models

Much of Ryan and Deci's (2000) self-determination theory has been supported by this study, particularly the importance of feelings of competence and feelings of relatedness as mainsprings of self-motivation, well-being and exploratory behaviour. Feelings of competence should lead to feelings of autonomy and self-regulation, although succeeding years in higher education bring new challenges. Likewise, Lui and Andrade's (2022) model emphasised self-efficacy, goal orientation, mindset and task motivation, all of which could be developed by reciprocal and nonreciprocal peer tutoring and mentoring. The six motivational determinants in the Lui and Andrade model also included beliefs and conceptions about assessment, task value and prior knowledge, which have not featured in the present study. Regarding the MISCA model of Panadero and Lipnevich (2002), of their five elements (Message, Implementation, Student, Context and Agents), only Agents was addressed by this study (agentic describes an individual's capacity to control his or her own goals actions and destiny, in relation to the mode of interaction).

6.2. Limitations and strengths and further research

Students self-chose to be participants or non-participants. It is not known if any consistent selection bias occurred, whether towards more motivated students or towards more vulnerable students. As this was a post-only study, nor is it known to what extent the participants were equivalent in terms of their social integration, academic commitment, and commitment attitude before the study, in different years of entry and in relation to participants vs. non-participants. However, we do not see how pre-tests of these variables at the beginning of the first year when the students would not have had any experience of their new environment would have made any sense to the participants. Mandatory participation is one solution, but some students react negatively to expected attendance (or required attendance). Nonetheless, the results do show marked differences between groups.

The inferential statistical analysis investigated differences between participant and non-participant groups, while the comparisons between interventions were done solely in relation to relative Effect Sizes. We accept that Effect Sizes are greatly influenced by degree of variation within samples and other ancillary variables, and might not be the most reliable of indicators. Another important limitation of this study is that the multilevel effects of students being nested within the class groups were not checked (for context variables, for example). Nonetheless, implementing interventions in several settings in order to assess which conditions need to be satisfied is essential (Tinto, 1993) and that is what has been done here. An increase in the number of interventions, cases and observations would help the investigation of institutional-level effects as well as allowing for a more fine-grained analysis.

On the positive side, this was a mixed methods study, albeit post-only, with triangulated results and all the benefits in terms of reliability which that involves. The study involved multiple conditions across multiple outcomes, as compared to other studies where researchers investigated fewer intervention conditions and fewer outcomes.

7. Conclusion

Given that we do not know if the self-selected groups were in any way biased and that there was no pre-test of the variables measured, and the uncertainty about the reliability of effect sizes, extreme caution is needed regarding conclusions. Regarding the research question: Which of the four interventions of reciprocal or nonreciprocal tutoring or mentoring, achieves a higher level of first-year students' social integration, academic commitment, commitment attitude and persistence? On Social Integration, participants were significantly better than non-participants (effect sizes – ESs:.255,.227). Both types of mentoring (ES = .424,.310) did better in terms of effect sizes than both types of tutoring (.365.308), but tutoring effects were also of some substance. On Academic Commitment, overall participants and non-participants were not significantly different. However, in terms of effect sizes reciprocal peer mentoring (ES = .301) and nonreciprocal peer tutoring (ES = .409) both did well. On Commitment Attitude, participants did significantly better than non-participants. All four interventions showed strong positive impact: reciprocal peer mentoring (ES = .628), nonreciprocal peer mentoring (ES = .501), reciprocal peer tutoring (ES=.356) and nonreciprocal peer tutoring (.603). On Intention to Stay, participants did better than non-participants (ES = .200). Nonreciprocal peer mentoring did well (but ES was only .060). On Motivation to Stay, participants did better than non-participants (ES = .264).

Regarding the research question: How do student perceptions of the nature of feedback differ between these conditions? Nonreciprocal peer feedback had greater diversity from exposure to older role models,

reduced student anxiety and increased academic engagement and fostered a sense of belonging. Reciprocal peer feedback encouraged student collaboration and support, togetherness and team spirit, a positive group climate and social integration. It developed empathy between students, confidence in ability to help others and provide feedback and enhanced self-esteem.

In this study the relative strengths and weaknesses of different kinds of peer assisted learning have been explored, together with the role of feedback in each of them and their effects on social integration and academic integration, which are intertwined. Overall, our results suggest that both have advantages, and consequently students might be given the opportunity to experience both at an early stage in their first year. After that, they could make more informed choices about which form they prefer, or continue to participate in both. For institutions, making both available has resource implications, although these are modest, but nonetheless the investment seems worthwhile.

Financial Disclosure

The authors have no relevant financial relationships to disclose.

Code Availability

Codes within MAXQDA available to other researchers on request.

Conflict of Interest

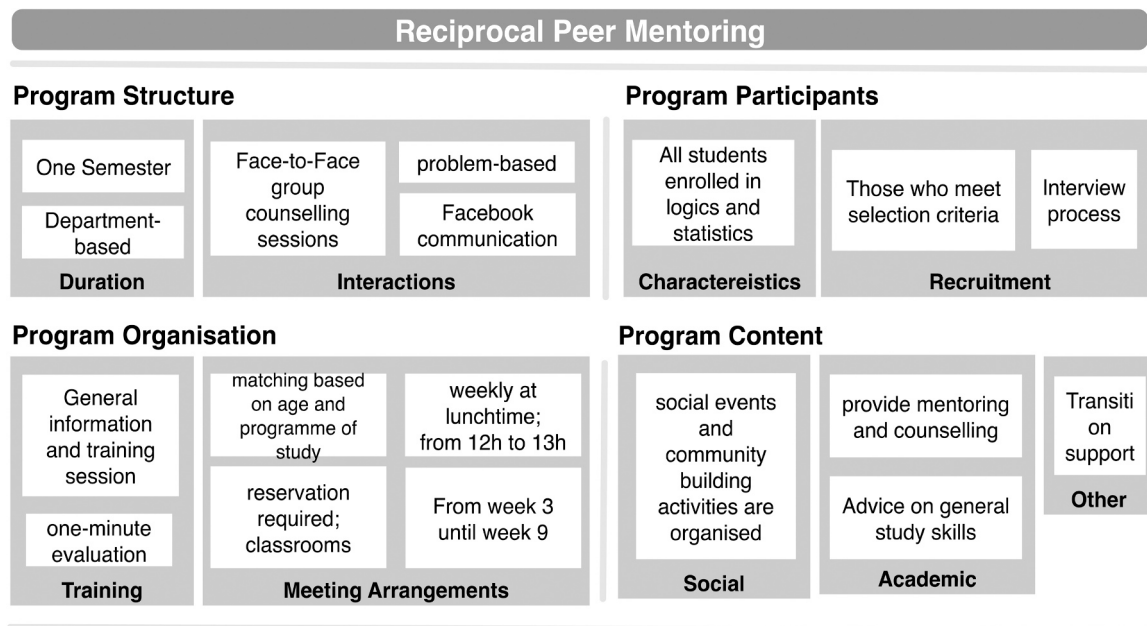
The results of this study do not create a conflict of interest for any of the co-authors.

Availability of Data

The data can be made available to other researchers on request.

Appendix 1

Types of peer assisted learning



Traditional Peer Mentoring

Program Structure

One Year	Face-to-Face / online	Person-centred
Faculty-wide	Individual Consultations	Smart phone communication
Setting, Duration	Interactions	

Program Participants

All beginning students P.E. regardless of Department	Anyone who volunteers	no Interview process
Characteristics	Recruitment	

Program Organisation

No training	Formalised matching process	Weekly before dinnertime; from 16h to 19h
No evaluation	Inside and outside campus	From week 3 until week 7
Training	Meeting Arrangements	

Program Content

walks, city games, dinners, etc.	Provide Monitoring	Preventive support but not explicitly defined.
Social	Academic	Other

Reciprocal Peer Tutoring

Program Structure

One Semester	Face-to-Face group meetings	strength based
Course-based	email communication	
Duration	Interactions	

Program Participants

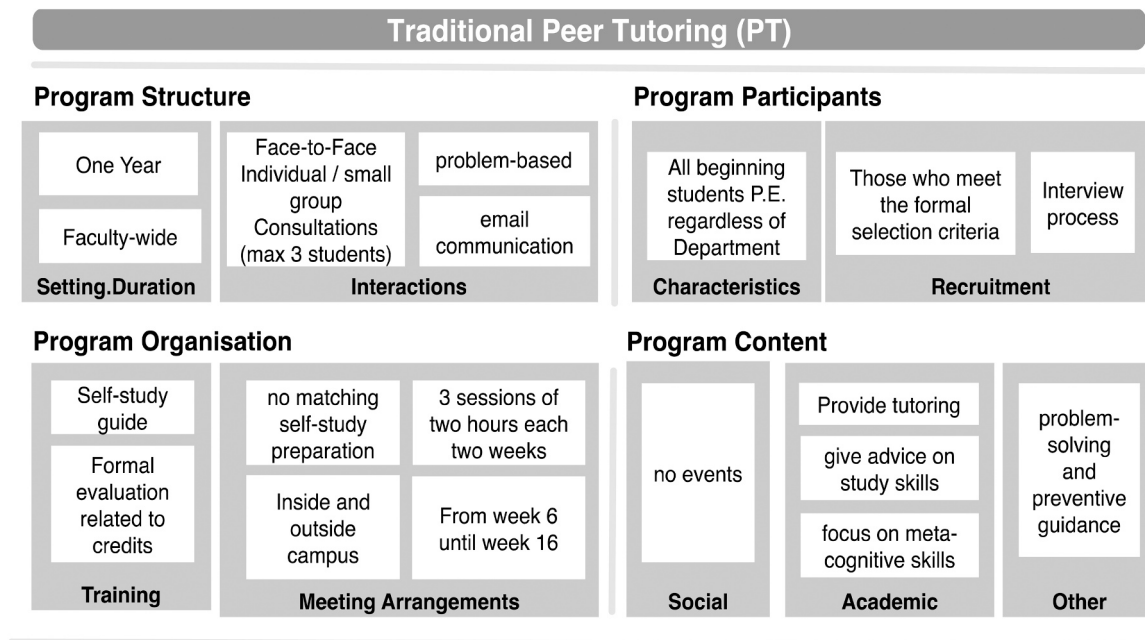
All students enrolled in logics and statistics	Those who meet selection criteria	Interview process
Characteristics	Recruitment	

Program Organisation

General information and training session	spontaneous matching	weekly at lunchtime; from 12h to 14h
no evaluation	reservation required; faculty meeting rooms	From week 10 until week 13
Training	Meeting Arrangements	

Program Content

No social events	Provide Tutoring	No other content
Social	Advice on particular study skills related to logics or statistics	Other
	Academic	



Appendix 2

Online questionnaire
 To what extent do the following statements apply to you?
 Indicate if:
 Not at all: Not much: In between: To some extent: Completely.

Academic commitment

- I keep up with my lessons well.
- I know why I am at university.
- I do not work so hard on my studies as I should.
- My study goals are clearly defined.
- Lately I have not studied very efficiently.
- I have recently had difficulty in concentrating when I try to study.
- I have fun with my studies at the university.
- I find it hard to start studying.
- I am very pleased with my studies at university.
- Lately I have not been really motivated to study.

Social integration

- I feel well adapted and incorporated into the university environment.
- In university I meet so many people and I make many friends.
- I have lately often felt lonely in college.
- I feel good at the university.
- I feel that I am very different from the other students at the university.
- I have several close social relations at the university.
- I feel that I have enough social skills.
- I am satisfied with the extent to which I participate in social activities in college.
- I have some good friends at university I can talk to about all my problems.
- I am very satisfied with my social life at the university.

Commitment

- What I feel about my education and faculty: I am proud.
- What I think about my education and faculty: I belong.
- What I do for my study programme and faculty: I participate.

Persistence

I am happy with the decision to go to university.
 I am happy with the decision to come and study at this university.
 I want to study at this programme until I have obtained my diploma.
 I wish I had studied at another university or college.
 I have already thought about quitting this course and doing something else.

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