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Differences between blended and face-to-face teaching in students' perception

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Abstract

This study investigates student perceptions of blended and face-to-face teaching and their connection to perceived learning and satisfaction. Five dimensions are examined: relation to the subject matter, self-efficacy to complete the course, to interact with the teacher and peers, and the teacher's pedagogical stance. We used a questionnaire which was completed by 134 students following seven different blended teaching courses. Results show that students felt more able to interact with teacher and peers in face-to-face compared to blended teaching condition. Self-efficacy to complete the course, to interact with peers and teacher's pedagogical stance emerged as key predictors in blended teaching courses for both perceived learning and satisfaction. These findings emphasize that enhancing interactions and teacher support are two important aspects to take into account to help students in blended courses.

Introduction

For more than two decades, blended learning has become an increasingly common learning modality within universities (Alqurashi, 2018; Tsai et al., 2020; Vo et al., 2020). For some authors, blended learning has consequently become a major issue in education (Allen et al., 2007; Prifti, 2020). This trend has become even more pronounced since the pandemic, which has led universities to increase their use of distance learning facilities. Blended education can be defined as "the combination of instruction from two historically separate models of teaching and learning: traditional face-to-face learning systems and distributed learning systems" (Graham et al., 2005, p. 5). Blended teaching thus combines both distance and face-to-face learning (Graham, 2006).

From an educational perspective, blended learning is emerging as a solution that can improve learning experiences and student engagement, facilitate access to educational content, and provide more flexible solutions for learning (Prifti, 2020). Perceived learning and satisfaction

are two widely used indicators of student success (Eom et al., 2006; Graham & Scarborought, 2001). Several studies have shown that in distance or blended teaching situations students are more successful than in a completely face-to-face teaching situation (Bernard et al., 2014; Means et al., 2013; Shea & Bidjerano, 2010, 2012). However, these findings need to be qualified in the light of the meta-analysis by Müller and Mildenberger (2021), which found no significant difference in student satisfaction depending on whether they attended blended or face-to-face course. This leads to the question of which dimensions most influence perceived learning and student satisfaction in blended and face-to-face teaching.

Looking at the pedagogical situations involved, it was found that face-to-face teaching facilitates interaction between students and the teacher through verbal and non-verbal communication (e.g. facial expressions and body language). This communication may allow students to express to the teacher their difficulties in understanding a course, and for the teacher to take this feedback into account to support his or her pedagogical stance (Garrison & Kanuke, 2004; Zilka et al., 2018). In addition, face-to-face teaching situations allow students who need interaction to guide their learning practice by copying the way other students do things or by taking their feedback into account (Groen & Li, 2005; Zilka et al., 2018). For student success, these studies tend to show the importance of, firstly, interactions between students and the teacher but also between the students themselves, and secondly the pedagogical stance of the teacher. These findings then seem important to consider in order to understand the impact of blended teaching on student success (Bernard et al., 2014).

The purpose of this study is to compare blended and face-to-face teaching from the students' perspective. Specifically, the study aims to measure students' perceived learning and satisfaction in both types of teaching in relation to their sense of self-efficacy to complete the course and interact with the teacher and other students, and their perception of the teacher's pedagogical stance.

Self-efficacy

Self-efficacy can be defined as "an individual's belief in his or her ability to perform a certain task yielding perceivably desired levels of performance appropriate to the skills, he/she has" (Bandura, 2004; see also Eom, 2012). According to a number of studies, self-efficacy is a factor that plays an important role in student success (Alqurashi, 2019; Liaw & Huang, 2013; Lim, 2001; Womble, 2007). Students with high self-efficacy tend to be more engaged in the course and more successful (Hsieh et al., 2007). For example, if a student does not feel able to succeed in a particular course, he or she is likely to put in less effort and feel more demotivated by the course. As a result, he or she will be less satisfied with the course and will feel that he or she has learned little. In the context of blended and distance teaching, students with higher self-efficacy tend to be more satisfied with this type of teaching (Liang & Tsai, 2008; Wu et al., 2010) and to be more engaged in their learning (Bates & Khasawneh, 2007). These findings are partly qualified by the fact that several studies show a lack of significant correlations between self-efficacy and satisfaction in blended or distance teaching (Jan, 2015; Simmering et al., 2009).

Three dimensions of self-efficacy can be identified: learner-content interaction (LCI), learner-instructor interaction (LII) and learner-learner interaction (LLI) (Alqurashi, 2016; Bernard et al., 2009). Learner-content interaction (LCI) is defined as the interactions that occur between students and the subject matter. Learner-instructor interaction (LII) is a two-way communication between learners and the instructor of the course. Learner-learner interaction (LLI) is a two-way communication between or among learners for the purpose of exchanging information or ideas related to course content (Alqurashi, 2018). In the context of blended teaching, another dimension of self-efficacy seems also important to consider and refers to the self-efficacy to complete online course (Shen et al., 2013; Tsai et al., 2020). This refinement

of self-efficacy in several dimensions allows us to better understand the variability of the links between self-efficacy, perceived learning and satisfaction. Indeed, several studies show that LCI (i.e. self-efficacy related to learner-content interaction) and self-efficacy to complete online courses strongly predict both students' perceived learning and satisfaction in online courses (Kuo et al., 2013; Kuo et al., 2014; Tsai et al., 2020). In contrast, LLI (i.e. self-efficacy related to learner-learner interaction) strongly predicts only perceived learning in online courses (Jiang & Ting, 2000).

Pedagogical stance

The way in which the instructor directs, guides, interacts with, and provides feedback to students also plays an important role in student success at the university (Caskurlu et al., 2020). Three sub-dimensions of teacher instructional stance have been identified as particularly related to student success: clear goal and expectation, instructor feedback and instructor support (Vo et al., 2020).

Clear goal and expectation

Learning is enhanced when the teacher clearly states the organization and objectives of the course as well as expectations (Mupinga et al., 2006; Pelz, 2010). This allows students to better organize themselves and use more appropriate learning strategies to achieve the objectives when they are made explicit by the teacher (Locke & Latham, 2002). In addition, students may be more engaged in class when they directly relate the content or activity to the teacher's expectations. In addition to the impact on student learning, Aubsurn (2004) showed that in distance learning, students were more satisfied when the instructor had clearly stated the course objectives and expectations.

Instructor feedback

Instructor feedback to the learner is defined as information given by the instructor to the students during the learning process to inform them of their learning progress or outcomes (Butler & Winne, 1995). This feedback is recognized as promoting a metacognitive attitude in learners, oriented towards strategies for planning, monitoring the task, controlling and adjusting performance (Zimmerman, 2000). Indeed, the feedback provided by the teacher helps learners to understand how they can improve by adapting and modifying their learning strategy or effort (Chen & Jang, 2010). In distance learning, instructor feedback has been identified as a predictor of student satisfaction (Assodar et al., 2016). Additionally, learners reported that informative and constructive feedback from the instructor had a positive impact on their class participation (Chou & Liu, 2005).

Instructor support

Instructor support is also considered to be particularly relevant to student learning (Chang et al., 2015; Lo, 2010; Paechter et al., 2010). Teacher support refers to the strategies used by the teacher to help learners think for themselves, apply their knowledge, or reflect on the content they have seen in class. In this context, the teacher is considered as a facilitator who stimulates, guides and challenges the learners by developing their autonomy. This type of supportive strategy makes it possible, for example, to clarify the steps to follow in order to complete a complex task (Laurillard, 2012), to help learners master the content seen in class (Lee et al., 2011), to promote higher-order thinking (Johnson, 2017), or to reduce dropout during class (Fryer & Bovee, 2018). More specifically, in the context of distance learning, instructor support can also refer to the help provided by the teacher to solve technical problems encountered by learners (Hung & Chou, 2015).

The present study

The aim of our study is to investigate how students' perceptions differ between two different learning situations: blended and fully face-to-face teaching. More specifically, we are interested in the links between students' success – understood as referring to perceived learning and satisfaction – and their perceptions of blended and face-to-face teaching. In this respect, several dimensions are particularly relevant to consider: relation to the subject matter (RSM), self-efficacy in following the courses (SEC), in interacting with the teacher (SET), in interacting with other students (SES), and the teacher's pedagogical stance perceived by the student (PS). These dimensions allow for a better understanding of the learning situations perceived by students. The influence of each dimension in isolation on students' perceived learning and satisfaction has been investigated in several studies. However, the links between these dimensions and their combined influence on the two outcomes deserve further investigation. This is what this study proposes to do, focusing on the context of university teaching. The research questions can be stated as follows: (RQ1) Are blended and face-to-face teaching perceived differently by students in terms of RSM, SEC, SET, SES and PS? ; (RQ2) To what extent do RSM, SEC, SET, SES and PS predict students' perceived learning and satisfaction in blended and face-to-face teaching?

Methodology

The courses selected in the study

The study was part of the AgilHybrid project, which started in September 2021 and aimed to implement blended teaching in various training programs belonging to different components of the University of Montpellier. This project provided funding for the digital equipment needed to implement blended teaching as well as a support and a follow-up in the construction of these courses. The present study has been conducted to evaluate these courses from the point of view

of the students who have experienced them. This evaluation is important to allow the teacher in charge of a blended teaching course to measure its impact on students and to make any necessary adjustments. It is also useful for the university to continue its support for this type of project.

Among all the supported blended courses, the study selected those that started during the first semester and ended before the beginning of the second semester, that offered only face-to-face assessment, that included more face-to-face hours than distance learning hours, and that were common core courses and not optional courses. In the end, seven blended courses were selected from four different faculties, involving a total of 697 students. A description of these courses is given in Table 1.

Table 1: Faculties, names of the courses, levels of study, purpose of the blended-learning courses declared by the teacher and pedagogical tools used for distance learning courses.

Faculty	**Name of the course**	**Level of study**	**Purpose of the blended-learning courses declared by the teacher / Pedagogical tools used for distance learning courses**
IAE	ERP management	2nd years of Master's Degree	Extending the access of the courses to more students / Distance learning courses included videos and PowerPoint presentations with sound to provide tutorials and case studies
	Human resources management	1st years of Master's Degree	Extending the access of the courses to more students and facilitating the access to teaching resources / Distance learning courses included videos and PowerPoint presentations with sound to provide professional role-playing
	Decision support tools and financial diagnosis	3rd years of Bachelor's Degree	Providing more teaching resources / Distance learning courses included videos and PowerPoint presentations with sound to provide case studies
Polytech	Functional Programming	2nd years of Master's Degree	Mixing theoretical and practical concepts / Distance learning courses included videos and interactive online exercises

	Intro WAO	3rd years of Bachelor's Degree	Mixing theoretical and practical concepts, providing more teaching resources and personalising learning paths / Distance learning courses included videos reviewing the key concepts of the course, links to additional resources, exercises and a chat room for exchanges between students and the teacher
Economics	Mathematics	2nd years of Bachelor's Degree	Personalising learning paths for students experiencing difficulties and providing more teaching resources / Distance learning courses included additional exercises
Medicine	Semiology	1st cycle of medical studies	Extending the access of the courses to more students / Distance learning courses included videos, podcasts and animated graphics

The questionnaire

The construction of the questionnaire required a collaborative work between all the stakeholders: the university service in charge of the management of the AgilHybrid project and the researchers who wrote the article. Most of the items used in this questionnaire were taken from the literature. Among the items found in previous studies, those with the best factor loadings were selected. These items were translated into French and some of them had to be reworded. Once the questionnaire was completed, its electronic version was tested on 4 students who had followed a blended teaching course not included in the AgilHybrid project. During this test, an experimenter was present and asked questions to the students in order to collect their impressions and to make sure that the items were well understood.

The questionnaire is structured as follows. At the beginning of the questionnaire, the student is presented with a consent form in which he/she is asked to agree to the use and storage of data related to his/her answers. The student is then informed that the next questions concern his/her feelings about two different courses: the first one is the blended course attended during the last semester, the second one concerns a face-to-face course of his/her choice. The name of the

blended course attended by the student is already entered in the questionnaire. The student is asked to select the face-to-face course of his//her choice according to three criteria: that it has a similar importance to the blended course in his/her curriculum, that it took place during the first semester, and that it consists only of face-to-face situations.

The student was then asked to complete each question for both the blended and the selected face-to-face teaching. The questionnaire consisted of 31 questions which students had to answer once for the blended course and then a second time for the fully face-to-face course, i.e. 62 questions in total. All items proposed a 7-point Likert scale for the response ranging from "Strongly disagree" (1) to "Strongly agree" (7). First, a series of questions were asked about students' relationship with the subject matter involved in the course, and then questions were asked about teachers' pedagogical stance related to the sub-dimensions: clear goals and standard scales (Ginns & Ellis, 2009), instructor support (Ausburn, 2004; Vo et al., 2020) and instructor feedback (Eon et al., 2006). Next, students' self-efficacy was examined through three sets of items corresponding to the three sub-dimensions identified in the literature: self-efficacy for completing the course, interacting with the teacher, and interacting with other students (Tsai, 2020). Finally, the questionnaire concluded with two items that asked students to rate their perceived learning and their satisfaction with the course at stake. All the questions are provided in the Supplementary material.

In addition to the students' responses to the questionnaire, sociological and academic data (e.g., gender, type of baccalaureate, year of graduation, students' occupation, and scholarship) were provided by the university administration.

Completion of the questionnaire

The survey methodology was as follows. Students were asked to answer via an email to an online questionnaire made with Sphinx. This questionnaire was sent to all the students and they

were asked to respond within three weeks after the end of the blended course and before the exam. The teachers responsible for the blended courses were asked to encourage their students to complete the survey. As the seven blended courses selected ended on different dates, students were contacted at different times during the semester. After several reminders to complete the survey, we received responses from 134 students, a response rate of 33.8%. Among these 134 students, 77 were female and 57 were male, age between 19 and 36 years at the time of the study. The data collected was processed anonymously.

Results

Before carrying out the statistical tests, the participants' data were first examined to identify possible outliers. The data of 8 participants providing exactly the same answer to all items were removed from the data file, resulting in a sample of 128 participants. All statistical analyses were performed with the JASP 0.15.0.0 software.

Exploratory factor analysis

An exploratory factor analysis was performed on all the items related to the following dimensions: Relation to the Subject Matter (RSM), Pedagogical Stance of the teacher perceived by the student (PS), Self-Efficacy to complete the Course (SEC), Self-Efficacy to interact with Teacher (SET) and Self-Efficacy to interact with other Students (SES). These analyses were carried out using the oblimin rotation method and the principal axis factoring as the estimation method. For each model, we ensured that the KMO's test values were not below 0.8, the uniqueness' values were not above 0.5, and that the Bartlett's test and the Chi-square test were significant. We determine the 5 factors by applying an analysis based on factor eigenvalues. The analysis of the factor loading shows that, except for two items, all of items fit well with the dimension to which they should be assigned (Table 2). Since one item

in the RSM dimension (item RSM1) and another one in the PS dimension (item PS2) had a uniqueness score higher than 0.5, we decided to remove them. The proportion of variance explained by the 5 factors is 0.806. After removing these two items, we then performed a reliability analysis in order to estimate the internal consistency of the different dimensions using McDonald's omega (Béland et al., 2017) which ranges from an indicator of 0.937 to 0.971 (Table 3). All the factor loadings, mean and standard deviation (SD) by item are provided in the Supplementary material.

Table 2. McDonald's omega, eigenvalues and proportion variance of the five independent latent variables.

Items questionnaire	**Factor 1**	**Factor 2**	**Factor**	**Factor 4**	**Factor 5**
McDonald's Omega (ω)	.95	.95	.94	.97	.96
Eigenvalues	1.28	13.19	1.52	3.73	2.14
Proportion variance	.13	.19	.14	.17	.16

Notes. (Factor 1) Relation with the Subject Matter (RSM); (Factor 2) Pedagogical Stance of the teacher perceived by the student (PS); (Factor 3) Self-Efficacy to complete the Course (SEC); (Factor 4) Self-Efficacy to interact with Teacher (SET); (Factor 5) Self-Efficacy to interact with other Students (SES).

Descriptive analysis

All variables were tested for normality prior to analysis using Shapiro-Wilk test (Table 3). The test shows no normal distribution for the different variables neither in the face-to-face nor in the blended teaching condition.

Table 3. Mean, standard deviation (SD) and Shapiro-Wilk test values for each dimension.

Variable	**Mean**	**SD**	**Shapiro-Wilk**	***p***
RSM	5.15	1.58	.917	< .001
PS	4.84	1.42	.959	< .001
SEC	4.77	1.35	.963	< .001
SET	4.20	1.74	.958	< .001
SES	4.56	1.68	.955	< .001
Perceived learning	4.83	1.62	.926	< .001
Satisfaction	4.85	1.62	.922	< .001

Paired Samples Wilcoxon test

We performed a Wilcoxon test to compare the participants' responses between the blended and face-to-face teaching conditions for each dimension (RQ1). The results show a significant difference for two of the dimensions: SET (i.e. Self-Efficacy to interact with the Teacher) and SES (i.e. Self-Efficacy to interact with other Students) (Table 4). Students felt more able to interact with the teacher in the face-to-face condition (M = 4.32, SD = 1.71) compared to the blended teaching condition (M = 4.08, SD = 1.77), $W(127) = 1952$, $p = .041$, $r_{rb} = .267$. Students also felt more able to interact with other students in the face-to-face teaching condition (M = 4.75, SD = 1.55) compared to the blended teaching condition (M = 4.38, SD = 1.78), $W(127) = 2205$, $p = .020$, $r_{rb} = .296$. It is worth noting that the results showed no significant difference in students' responses to the RSM (i.e. Relation to the Subject Matter) and PS (i.e. teacher's Pedagogical Stance perceived by the student) dimensions between the blended and face-to-face teaching conditions ($W(127) = 1427$, $p = .150$ for RSM and $W(127) = 2603$, $p = .374$ for PS). This means that the face-to-face teaching that was chosen by the students does not differ from the blended teaching either in terms of the student's evaluation of the subject matter or in terms of the teacher's pedagogical stance as perceived by the students.

Table 4. Mean, standard deviation (SD), values of Wilcoxon test, p-values and rank-biserial correlation for each variable compared between face-to-face and blended teaching conditions.

Variable	$M_{Face\text{-}to\text{-}face}$ (SD)	$M_{Blended}$ (SD)	Wilcoxon test	*p*	r_{rb}
RSM	5.12 (1.52)	5.18 (1.64)	1427	.150	– .181
PS	4.78 (1.42)	4.90 (1.41)	2603	.374	– .099
SEC	4.80 (1.24)	4.76 (1.46)	2218	.463	– .086
SET	4.32 (1.71)	4.08 (1.77)	1952	.041	.267
SES	4.75 (1.55)	4.38 (1.78)	2205	.020	.296
Perceived learning	4.88 (1.62)	4.77 (1.62)	1804	.634	.060
Satisfaction	4.94 (1.42)	4.76 (1.80)	2189	.567	.069

Multiple linear regression

Multiple regression analyses were conducted to determine whether the dimensions we examined predicted our two outcome variables, i.e. perceived learning and satisfaction, in the face-to-face and in the blended teaching conditions (RQ2). For each of the multiple regressions, we checked for the presence of collinearity (VIF above 4 and Tolerance below .25), constant variance (random distribution when plotting actual residuals against predicted residuals) or an abnormal distribution of residuals (Q-Q plot showing that the standardized residuals fit along the diagonal). The required conditions were met.

In the face-to-face teaching condition, regression results indicate that the model with SEC and SES significantly predicts student perceived learning ($R^2 = .422$, $R^2_{adj} = 0.412$, $F(2, 127) = 45.567$, $p < .001$). This model explains for 41.2% of the variance in student perceived satisfaction. Among these two significant predictors, SEC was stronger ($\beta = .369$, $p < .001$, CI = [.287; .682]) compared to SES ($\beta = .394$, $p < .001$, CI = [.255; .568]) (Table 5).

Table 5. Multiple regression analysis with the five predictors and perceived learning as an outcome variable in face-to-face teaching condition.

							95% CI	
Model		**Unstandardized**	**Standard Error**	**β**	***t***	***p***	**Lower**	**Upper**
1	(Intercept)	.510	.501		1.017	.311	– .483	1.503
	RSM	– .023	.091	– .022	– .258	.797	– .203	.156
	PS	.121	.121	.106	.999	.320	– .119	.360
	SEC	.372	.129	.284	2.882	.005	.116	.628
	SET	.077	.091	.081	.843	.401	– .104	.257
	SES	.379	.085	.363	4.448	< .001	.210	.548
2	(Intercept)	.477	.483		.987	.325	– .479	1.432
	PS	.111	.114	.097	.972	.333	– .115	.336
	SEC	.363	.124	.277	2.933	.004	.118	.608
	SET	.081	.089	.086	.913	.363	– .095	.258
	SES	.376	.084	.361	4.467	< .001	.210	.543
3	(Intercept)	.440	.481		.916	.361	– .511	1.392
	PS	.156	.102	.137	1.534	.128	– .045	.358
	SEC	.372	.123	.284	3.016	.003	.128	.616

	SES	.403	.079	.386	5.102	< .001	.247	.559
4	(Intercept)	.608	.471		1.291	.199	– .324	1.539
	SEC	.484	.100	.369	4.866	< .001	.287	.682
	SES	.412	.079	.394	5.195	< .001	.255	.568

Notes. Relation with the Subject Matter (RSM); Pedagogical Stance of the teacher perceived by the student (PS); Self-Efficacy to complete the Course (SEC); Self-Efficacy to interact with Teacher (SET); Self-Efficacy to interact with other Students (SES).

Still in the face-to-face condition, another standard multiple regression was run to determine whether all five independent variables (RSM, PS, SEC, SET, SES) predict satisfaction. With satisfaction as the dependent variable, the regression results indicate that the model with two of the five independent variables (SEC et SES) significantly predicts satisfaction ($R^2 = 0.356$, $R^2_{adj} = 0.346$, $F(2, 127) = 34.552$, $p < .001$). This model explains for 34.6% of the variance in satisfaction. SES was the stronger predictor ($\beta = .418$, $p < .001$, CI = [.238; .529]) compared to SEC ($\beta = .278$, $p < .001$, CI = [.138; .504]) (Table 6).

Table 6. Multiple regression analysis with the five predictors and satisfaction as an outcome variable in the face-to-face teaching condition.

							95% CI	
Model		**Unstandardized**	**Standard Error**	**β**	***t***	***p***	**Lower**	**Upper**
1	(Intercept)	1.541	.470		3.281	.001	.611	2.471
	RSM	.027	.085	.029	0.317	.752	– .141	.195
	PS	– .022	.113	– .022	– .197	.844	– .247	.202
	SEC	.284	.121	.246	2.347	.021	.044	.523
	SET	.072	.085	.086	.837	.404	-.098	.241
	SES	.357	.080	.390	4.477	< .001	.199	.515
2	(Intercept)	1.529	.464		3.297	.001	.611	.446
	RSM	.021	.080	.023	.268	.789	– .137	.179
	SEC	.275	.112	.239	2.451	.016	.053	.497
	SET	.064	.075	.076	0.847	.398	– .085	.212
	SES	.359	.079	.392	4.557	< .001	.203	.516
3	(Intercept)	1.569	.437		3.587	< .001	.703	2.434
	SEC	.289	.100	.250	2.883	.005	.090	.487
	SET	.063	.075	.075	0.840	.403	– .085	.210
	SES	.361	.078	.394	4.615	< .001	.206	.516
4	(Intercept)	1.579	.437		3.615	< .001	.714	2.443
	SEC	.321	.092	.278	3.474	< .001	.138	.504
	SES	.384	.073	.418	5.221	< .001	.238	.529

In the blended teaching condition, Table 7 shows that perceived learning as an outcome is significantly predicted by three factors, i.e. PS, SEC and SES (R^2 = .578, R^2_{adj} = 0.568, F(3, 127) = 58,601, p < .001). This model explains for 56.8% of the variance in perceived learning. SEC was the stronger predictor (β = .385, p < .001, CI = [.223; .631]) compared to PS (β = .281, p = .002, CI = [.121; .525]) and SES (β = .206, p = .004, CI = [.060; .317]) (Table 7).

Table 7. Multiple regression analysis with the five predictors and perceived learning as an outcome variable in the blended teaching condition.

							95% CI	
Model		**Unstandardize**	**Standard Error**	**β**	***t***	***p***	**Lower**	**Upper**
1	(Intercept)	.414	.382		1.083	.281	– .342	1.170
	RSM	– .043	.071	– .044	– .614	.540	– .183	.096
	PS	.335	.109	.292	3.063	.003	.119	.552
	SEC	.403	.107	.363	3.780	< .001	.192	.615
	SET	.118	.077	.128	1.522	.131	– .035	.271
	SES	.124	.076	.136	1.643	.103	– .025	.274
2	(Intercept)	.330	.356		.928	.355	– .374	1.035
	PS	.311	.102	.270	3.056	.003	.110	.512
	SEC	.392	.105	.353	3.739	< .001	.185	.600
	SET	.123	.077	.134	1.604	.111	– .029	.275
	SES	.126	.075	.138	1.677	.096	– .023	.275
3	(Intercept)	.337	.358		.942	.348	– .372	1.047
	PS	.323	.102	.281	3.161	.002	.121	.525
	SEC	.427	.103	.385	4.134	< .001	.223	.631
	SES	.188	.065	.206	2.895	.004	.060	.317

A further linear regression was carried out to determine the independent variables that significantly predicted satisfaction as an outcome in the blended teaching condition. Results show that four factors were involved (R^2 = .0.557, R^2_{adj} = 0.543, F(4, 127) = 38,649, p < .001) and predicted 54.3% of the variance of satisfaction. SEC was the stronger predictor (β = .400, p < .001, CI = [.256; .728]) compared to PS (β = .373, p < .001, CI = [.229; .723]), SES (β =

.152, p = .042, CI = [.006; .301]) and RSM (β = –.159, p = .032, CI = [–.333; –.015]) (Table 8).

Table 8. Multiple regression analysis with the five predictors and satisfaction as an outcome variable in the blended teaching condition.

Model		Unstandardize	Standard Error	β	*t*	*p*	95% CI	
							Lower	Upper
1	(Intercept)	.288	.437		.659	.511	– .577	1.153
	RSM	– .164	.081	– .150	– 2.030	.045	– .324	– .004
	PS	.461	.125	.361	3.681	< .001	.213	.709
	SEC	.462	.122	.375	3.782	< .001	.220	.703
	SET	.100	.089	.098	1.131	.260	– .075	.276
	SES	.104	.086	.103	1.206	.230	– .067	.275
2	(Intercept)	.313	.437		.717	.475	– .552	1.178
	RSM	– .174	.080	– .159	– 2.166	.032	– .333	– .015
	PS	.476	.125	.373	3.820	< .001	.229	.723
	SEC	.492	.119	.400	4.130	< .001	.256	.728
	SES	.154	.075	.152	2.056	.042	.006	.301

Discussion

This study aims to better understand students' perception of blended teaching in relation to their perceived learning and satisfaction. We used different dimensions to compare students' perceptions between blended teaching and face-to-face teaching (RQ1). The results indicate that students' perceptions are not significantly different between the two teaching conditions in terms of the relationship to the subject matter, the pedagogical stance of the teacher, and self-efficacy to complete the course. However, the results show that students feel more able to interact with the teacher and with other students in face-to-face teaching than in blended teaching. Importantly, this difference is not due to a bias in students' relationship with the subject matter in the two types of teaching. In fact, no significant difference was observed in this dimension of students' perceptions. This difference in self-efficacy to interact with the teacher between the two types of teaching is consistent with other studies showing that

distance teaching reduces interactions (Garrison & Kanuke, 2004; Zilka et al., 2018). This reduction in distance interactions can be explained in part by the fact that in this type of course, interactions only take place through verbal exchanges, as opposed to face-to-face teaching where interactions are enriched by non-verbal exchanges (Zilka et al., 2018). One of the challenges of blended teaching seems to be to compensate for the lack of non-verbal exchange with more enriching verbal interactions.

The results show no difference between blended and face-to-face teaching in students' perceived learning and satisfaction. This finding confirms what was highlighted in the meta-analyses by Müller and Mildenberger (2021). However, as two others meta-analyses have found contradictory results (Bernard et al., 2014; Means et al., 2013), it is important to better understand what depends on students' perceived learning and satisfaction by looking more carefully at students' perceptions of teaching.

We were interested in the predictive weights of our different factors on students' perceived learning and satisfaction in blended and face-to-face teaching (RQ2). In terms of students' perceived learning, self-efficacy in attending classes and interacting with other students are the two most predictive factors for both blended and face-to-face teaching. Only for blended teaching does a third factor emerge as predictive of perceived learning: teacher's pedagogical stance as perceived by the student. According to this result, students attach more importance to the teacher's approach in blended teaching. One possible interpretation is that blended teaching presents new educational challenges related to distance teaching and its connection to face-to-face teaching, requiring significant support from the teacher. The content of blended teaching considered in our study was implemented before the start of this study, initially using face-to-face teaching methods, and was subsequently adapted to include distance teaching during the course of the study year. Teachers were not yet accustomed to

practice these distance teachings. These results suggest the need to adapt the teaching practices and to support teachers in this process.

Regarding students' perceived satisfaction, again self-efficacy to complete the course and interaction with other students are the two most predictive factors for both blended and face-to-face teaching. However, the teacher's pedagogical approach as perceived by the student, as well as the student's relationship with the subject matter, also predict satisfaction in blended teaching. As with perceived learning, the teacher's approach seems to be more important for student satisfaction in the context of blended teaching. This result could be interpreted in a similar way to the case of perceived learning: blended teaching presents new pedagogical conditions to students that require them to change their learning practices, and this places new demands on the teacher. The presence or absence of sufficient teacher support plays an important role in student satisfaction.

Moreover, results show that the more students have a negative relationship with the subject matter, the more satisfied they are when the teacher's pedagogical approach, their ability to follow the course, and their ability to interact with other students are rated positively in blended teaching classes. In the case of blended teaching, students may expect to be less satisfied if they do not like the subject matter. Therefore, when blended teaching is rated positively, students are even more satisfied if they expected to be disappointed.

Several important limitations of our study must be acknowledged. There is a wide variety of courses attended by students, and we were not able to provide more information about the organization of the courses. This would have allowed us to better distinguish the contribution of distance and face-to-face classes in blended teaching for each of the variables studied. It is therefore possible that our sample includes students who have taken courses that vary in the way they have been blended. In addition, the experimental design of our study would have

been improved if we had compared the same courses, implemented in the face-to-face condition with one group of students and in the blended condition with another group of students. However, such a study requires a large sample of students, which can be challenging to obtain. Finally, in the context of our study, the size of our sample remains small regarding the multiplicity of the dimensions investigated which may have obscured the influence of certain predictors in the analyses.

Despite these limitations, the findings of our study highlight the importance of interactions in blended teaching situations. In order to improve these interactions, digital tools that promote interactions between students and with the teacher, as well as a teacher's approach that guides students' learning strategies in blended teaching seem important points to help students succeed.

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