

# The Supervisor of Undergraduate Dissertations in a Web-Based Context: How Much Support and How to Give it?

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## Abstract

The provision of support has always been central to the role of the undergraduate dissertation (UD) supervisor, but little research has been done on its contextual determinants in web-facilitated contexts. Beyond the general recognition of the importance of institutional support for the development of supervisors' technological and pedagogical knowledge and the importance of technology and pedagogy in maximizing the impact of supervisors' support for students, the effect of technology tools and students' prior skills on the type and level of supervisors' support is not well understood. Drawing partially on the Technological Pedagogical and Content Knowledge (TPACK) framework, the present work uses Partial-Least Square Structural Equation Modelling to examine the effect of supervisors' Technological Pedagogical Knowledge (TPK), their perception of students' soft skills, and the technology tools they use (face-to-face, social media or a learning management system) on the level of educational and motivational support they provide. The results indicate that institutional support to UD supervisors positively affects their TPK, which in turn positively affects their educational and motivational support to students. However, supervisors' educational and motivational support is inversely related to their perception of students' soft skills and is also affected by the technological tools used. In short, supervision styles are not static since different contextual factors affect the management of the process of supervision. The implications for UD supervision are discussed, and some recommendations are proposed in the article.

*Keywords:* Higher education, undergraduate dissertation, supervisor's support, technological knowledge, technological tools

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The undergraduate dissertation (UD) is usually the first opportunity for students to apply their knowledge and demonstrate their research potential, critical thinking, and oral and written communication skills (Feather et al., 2014). For supervisors, however, UD supervision is an arduous task. Supervisors need to dedicate time and energy they may not have (Sloan et al., 2014; Vehviläinen & Löfström, 2016), or which could be channeled to other career-advancing tasks (Roberts & Seaman, 2018). The literature on UD supervision generally refers to the dilemma of supervisors' support versus students' autonomy (Vehviläinen & Löfström, 2016), but the ways various contextual factors affect supervisors' support for their students are largely under-researched. Particularly important in the current context of mass higher education (HE) and the fast-paced shift to web-based supervision (Scagnoli et al., 2019) are institutional support to supervisors, supervisors' perceptions of students' soft skills and the technological tools used in the process of supervision. The importance of institutional support for UD supervisors for the effective use of technology stands out, given the gamut of tools available to supervisors and the potential impact of any tool chosen on the supervision process. While institutional support is known to affect supervisors' use of Information and Communication Technologies (ICT) (Rienties et al., 2013; Wan & Zhao, 2021), whether this impact translates to more or less support to students is not well understood.

As a practice with a long tradition in higher education, UD supervision is generally resistant to change (Jaldemark & Lindberg, 2013), but the recent large-scale upheavals worldwide left no room for resistance as technology is now unavoidable (Bouziane & Elaasri, 2019; Roberts & Seaman, 2018). However, its use is constrained by the degree of institutional support for supervisors (Hénard & Roseveare, 2012), which affects both their pedagogical knowledge and the technological tools they use (Al-Busaidi & Al-Shihi, 2012; Pedro & Kumar, 2020). Another factor affecting UD supervision is the drive for soft skills development in educational contexts (Kyllonen, 2013). Many Moroccan universities institutionalized soft-skills courses during the first two years of undergraduate education with the objective that students would apply those skills in their UD and later for their employability. As a consequence, supervisors' evaluation of what students can or can't do affects the amount of time and energy they are willing to invest in the process of UD supervision (Augustsson & Jaldemark, 2014; Vehviläinen & Löfström, 2016). But here also, the extent and magnitude of the effect of supervisors' perception of students' prior soft skills are not well estimated.

Therefore, given today's centrality of soft skills, institutional support, and technology, it is important to examine their impact on the UD supervisor since, as mentioned above, the UD experience provides the first opportunity to see that impact. Specifically, the present study examines the effect of institutional support on supervisors' TPK as well as the effect of supervisors' TPK, their perception of students' soft skills, and the technological tools they use on the level of educational and motivational support provided to students.

## Literature Review

### Setting

The Moroccan Ministry of Higher Education, Scientific Research and Innovation (MHESRI) has recently launched The National Initiative for the Acceleration of the Transformation of the Higher Education, Scientific Research and Innovation Ecosystem (MHESRI, 2022). The reform's objective is to overhaul HE governance to improve knowledge production. In particular, it aims to develop students' soft skills and help faculty smoothly

transition to online education. While the emphasis on soft skills and technology is not new, it now takes an increasingly greater place in the national debate over the role of undergraduate programs in public HE institutions, as indicated by the recent report by the Conseil Supérieur de l'Éducation, de la Formation et de la Recherche Scientifique (CSEFRS, 2018).

Concerning the task of UD supervision, supervisors in Moroccan public HE institutions acknowledge the benefits of the dissertation, but they admit that their ability to support students is limited by various hurdles related to supervisors' technological competence, students' skills, and institutional support (Zeddari, 2018). For this reason, the Moroccan context provides a suitable setting to explore how these hurdles affect the process of UD supervision. The Moroccan plan for the accelerated integration of technology mirrors similar responses to the new challenges facing higher education worldwide and the imperative to manage the role of technology for better teaching and learning (CSEFRS, 2018; Maor, 2017). The study of the effect of these factors is of paramount importance since it is likely to inform decision making concerning professional development for supervisors and training on the selection and pedagogical use of technology (Minocha & Petre, 2012). Likewise, examining supervisors' evaluation of soft skills is likely to uncover one source of bias that may affect, negatively or positively, the provision of adequate support for students when doing their UD (Chamorro-Premuzic et al., 2010).

### **Institutional Support for Supervisors**

Institutional support is a key element for quality teaching and generally refers to the measures taken at the level of the institution to improve teaching staff knowledge and practices (Hénard & Roseveare, 2012). As a crucial contextual factor, institutional support includes training and the provision of adequate technological infrastructure (Zuvic-Butorac & Nebic, 2009, Koh, Chai & Tay, 2014). Hénard (2010) suggested that the institutional environment positively impacts students' learning outcomes through improving the knowledge and competence base of teachers (p.9). In addition, HE institutions today need to provide professional development opportunities and support units for teaching staff to address the challenges of the increasingly standard web-facilitated contexts (Bouziane & Elaasri, 2019; Pedro & Kumar, 2020). In online and web-facilitated contexts, researchers suggest that the provision of training is key for teachers to integrate technology pedagogically for content in their disciplines (Löfström & Nevgi, 2008). Rienties et al. (2013) found that teachers' TPACK—as well as their satisfaction—increased after training on ICT. A similar result was also obtained by other researchers (Wang & Zhao, 2021; Koh et al., 2014).

For the task of supervision, Maor and Currie (2017) suggest that it requires a pedagogy that is different from classroom pedagogies. Such pedagogy entails a shift from a product-oriented to a process-oriented form of supervision where supervisors use technology to support students. Therefore, notwithstanding the unanimity in the literature on the positive impact of institutional support on teachers' competence, little research focuses on the impact of institutional support on their role as supervisors and the consequences of that role for students.

### **Supervisors' Support for Students**

For the type of support UD supervisors provide, McMichael (1992) distinguished between educational support on the one hand and personal support on the other. Educational support included help with goal setting, methodology, and the structuring of the dissertation. Motivation and rapport constituted key roles in the provision of personal support (McMichael,

1992). Similarly, Greenbank and Penketh (2009) referred to guidance and affiliation as critical tasks of the supervisor who represents a lifeline for students (Smith et al., 2009). In Del Río et al. (2018), the students surveyed identified the provision of motivation as one crucial token of affiliation. Strebel et al. (2019) and Vera and Briones (2015) found that educational support and motivational support correlated positively with students' satisfaction. In web-facilitated supervision, supervisors use technology to maintain connections and create communities to increase students' output in terms of collaboration and production (Maor & Currie, 2017; Donnelly & Fitzmaurice, 2013).

However, many studies also reported that supervisors struggle to maintain the balance between too much and too little support (Jamieson & Gray, 2006; Vehviläinen & Löfström, 2016). In particular, the factors affecting supervisors' enactment of support are little understood. Augustsson and Jaldemark's (2014) analysis of supervisors' written feedback resulted in the identification of different types of feedback that were qualitatively different in terms of their authoritative weight, which in turn depended on the purpose of feedback. De Kleijn et al. (2012) reported a positive correlation between students' perception of supervisors' degree of affiliation and control and their perceived contribution to the dissertation. Supervisors' knowledge of and competence in using technology is also reported as one determinant of the level of support for students, be it educational technology (Oehne & Bardua, 2019) or social media (Minocha & Petre, 2012).

In short, it is known that supervisors adapt their pedagogical interventions based on their diagnosis of the situation (Agricola et al., 2020; Vehviläinen & Löfström, 2016), but what exactly supervisors diagnose is not clear. In the present work, students' soft skills constitute one input in supervisors' diagnosis in addition to supervisors' TPK.

### **Students' Soft Skills**

Kechagias' (2011) definition of soft skills as intra- and inter-personal skills essential for success at the personal, social, and professional level has been cited widely in the literature (Macquail et al., 2021), but the broadness of the inventory of soft skills has created a lack of conceptual precision of the term (Gibb, 2014; Tseng et al., 2019). The concept of "soft skills" is adapted here from Goldsmiths' inventory of soft skills to refer to critical thinking, oral and written communication, and time management (Chamorro-Premuzic et al., 2010). The rationale for this is that many studies underscore the importance of those skills in the Moroccan context (Elmouhtarim, 2018; Zeddari, 2018).

Generally speaking, research on UD supervision stresses the importance of supervisors' attitudes towards the UD and the role of students (Feather et al., 2014). In interviews, supervisors expect that students demonstrate their skills and abilities to conduct an independent piece of research (Feather et al., 2014; Jamieson & Gray, 2006). However, little work has been done on the impact of such expectations on UD supervision. Specifically, the impact of supervisors' assessment of students' soft skills on the level of support supervisors provide has not been empirically studied. Strebel et al. (2019), for example, found that students' previous grades—a proxy to their prior knowledge and skills—increase their satisfaction with the supervisor, but how prior grades affect supervisors themselves is not examined. Since the UD is the first opportunity for students to demonstrate their skills (Smith et al., 2009), and since supervisors' expectations affect the supervision process, whether supervisors' perception of students' prior soft skills impacts their level of support needs investigation.

### **Supervisor's Technological Pedagogical Knowledge**

Technological Pedagogical Knowledge (TPK) is one component of the Technological Pedagogical and Content Knowledge framework (TPACK) (Scott, 2021). TPACK is a comprehensive framework to examine how the various forms of knowledge—technological, pedagogical and content—interact and the effect of their interaction on teaching practices (Schmidt et al., 2009). TPK is about adapting and customizing technology to maximize learning outcomes rather than knowledge of any particular content or technology (Cox, 2008). Cox's definition of TPK is apposite to UD supervision since “an individual with this type of knowledge understands how technology could be used with general pedagogical strategies that could be applied independent of the specific content or topic being taught.” (Cox, 2008, p. 76). In the context of HE, TPACK is found to increase awareness of the affordances of technology for the delivery of content in pedagogically appropriate ways (Rienties et al., 2013). The use of specific technological tools in TPACK-based frameworks is also found to positively affect students' performance (Oehne & Bardua, 2019). However, while TPACK has been modified to suit different contexts and courses (Maor, 2017; Ouyang & Scharber, 2018), research on its use to drive instructional practice is limited. Limited still is research on its use in UD supervision.

### **Technological Tools**

Since technology alone does not lead to change (Koehler et al., 2013), supervisors need to be aware of the affordances, limitations, and potential harms of the technological tools they use (Del Río et al., 2018; Jaldemark & Lindberg, 2013, Minocha & Petri, 2012). Angeli and Valanides (2015) suggest that technology is most effective when used to support instruction rather than teach content, and Benson, Ward and Liang (2015) stress the key role of pedagogy, rather than technology, in truly transforming teaching practices.

In HE, social media and Learning Management Systems (LMS) are increasingly adopted in online and web-facilitated settings (Sloan et al., 2014; Sun et al., 2018). Social media are social networking platforms endowed with capabilities for audio, visual and textual content sharing (Simon, 2012, p. 31). LMS are popular e-systems for the management of distance and web-facilitated education (Ouajdouni et al., 2021).

Increased opportunities for collaboration and interactivity have been cited as one advantage of technological tools (Gray & Crosta, 2018). Sun et al. (2018) compared the use of WeChat and Moodle for knowledge construction and social interaction and found that participants used WeChat more for socialization and Moodle more for knowledge construction. Dos Santos and Cechinel (2019) found that chat and forums did not differ much in terms of their use by students and supervisors, but both preferred forums more for academic discussions. Dos Santos and Cechinel (2019) suggest that asynchronous tools allow for more time to critically think and reflect on content, whereas synchronous tools are more conducive to socialization. This general result has also been reported by others (Tang & Hew, 2020). Relatedly, dos Santo and Cechinel found no difference concerning students' and supervisors' preferences for online or face-to-face meetings for supervision, but Dowling and Wilson (2015) referred to some kind of “digital conservatism” manifested in the slow pace of technology adoption and caused by time constraints, preference for face-to-face meetings, and students' perceptions of supervisors' comfort with digital tools. Within the framework adopted here, technological tools are understood as yet another contextual factor that impacts supervisors' educational and motivational support for students.

## The Conceptual Framework

What can be gleaned from the literature review above is that several contextual factors affect the UD supervision process. The literature establishes a clear link between institutional support and the development of TPACK. In turn, researchers investigating TPACK confirm that it has a significant effect on supervision practices and ICT use. Albeit qualitative, many studies also have discussed the effect of supervisors' expectations on the process of supervision. Drawing partially on the TPACK theory and current work on ICT integration in education (Maor & Currie, 2017; Minocha & Petri 2012), the present work examines the effect of supervisors' TPK and their perception of students' prior soft skills on the level of support they provide during UD supervision. Also examined is the differential effect of WhatsApp, Learning Management Systems (LMS) and face-to-face meetings, (three tools available to supervisors), on the type and level of supervisors' support. A set of related hypotheses was developed. These are written as null hypotheses to reflect the exploratory nature of the model.

H1a: Supervisors' TPK has no effect on their educational support for students (ES).

H1b: Supervisors' TPK has no effect on their motivational support for students (MS).

H2a: Supervisors' perception of students' soft skills (SSS) has no effect on their educational support (ES).

H2b: Supervisors' perception of students' soft skills has no effect on their motivational support (MS).

Also in this study, we examine the effect of LMS, WhatsApp, and face-to-face channels on the level of ES and MS.

H3a: Supervisors' use of face-to-face meetings (F2F) has no effect on ES.

H3b: Supervisors' use of face-to-face meetings (F2F) has no effect on MS.

H4a: Supervisors' use of WhatsApp® (WA) has no effect on ES.

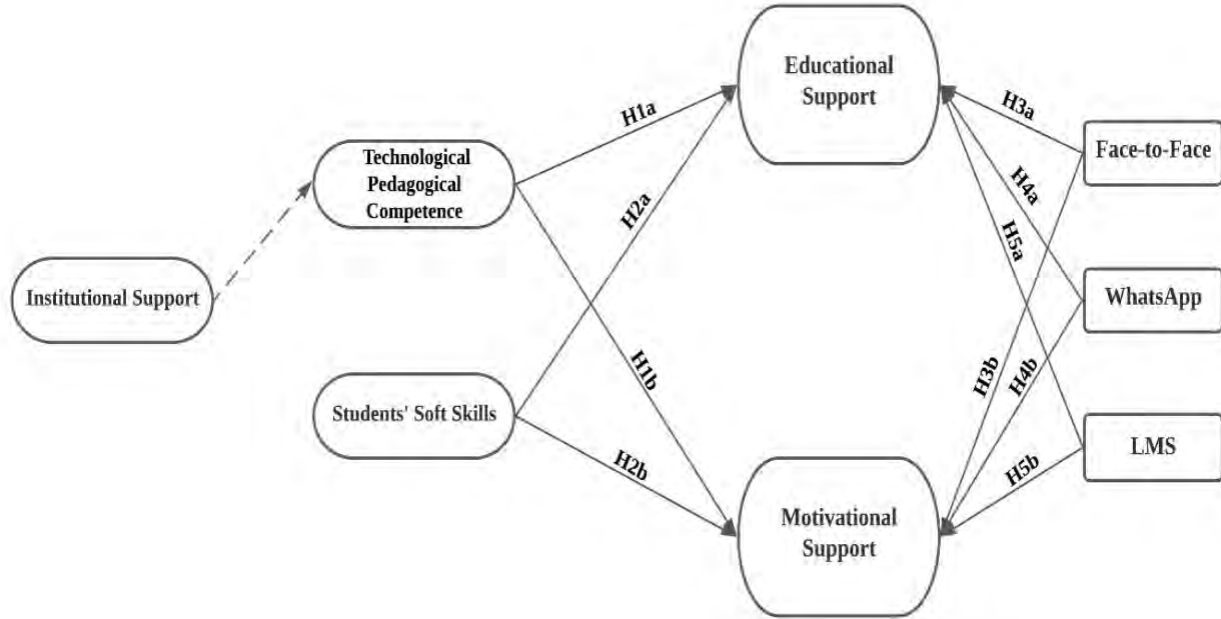
H4b: Supervisors' use of WhatsApp® (WA) has no effect on MS.

H5a: Supervisors' use of LMS has no effect on ES.

H5b: Supervisors' use of LMS has no effect on MS.

The alternative hypotheses to H1a and H1b translate the general belief that supervisors' decisions, if well informed by their TPK, will increase their level of support. For H2a and H2b, the alternative hypotheses reflect the assumption that supervisors' perception of students' soft skills impacts their balance of autonomy versus support or—to use the words of Strebel et al. (2019)—whether supervisors' will lean towards a more “laissez-faire” or a more “guidance” style. The alternative hypotheses to H3 to H5 link the tools used to the type and level of support. Finally, institutional support to supervisors is also included in the model as its impact on their TPACK and its components is well established in the literature. Figure 1 summarizes the relationships between the variables.

**Figure 1**  
*Model Specifications*



## Method

### Measurement

A questionnaire was designed to test the hypotheses provided above. The indicators for each construct were adapted from the literature to the UD context from the literature and translated into Arabic (Table 1).

Smart-PLS-3 was used for Partial-Least Squares Structural Equation Modeling (PLS-SEM). One advantage of using PLS-SEM is that it is robust against small sample sizes, simultaneously assesses the measurement and the structural model, and is a method used in complex causal relationships in prediction-oriented models (Hair et al., 2017).

**Table 1**  
*Questionnaire Constructs and Items*

<b>Section A</b>
<b>Institutional Support (IS)</b> (Simon, 2012)
IS1: My institution values online supervision as much as face-to-face supervision.
IS2: I attend training sessions that my institution organizes for supervisors.
IS3: Training is available on best practices of online supervision.
IS4: Training is available on how to use the technologies I need to supervise online.
<b>Students' Soft Skills (SSS)</b> (Chamorro-Premuzic et al., 2010)
SSS1: Students have critical thinking skills to complete their dissertations.
SSS2: Students have oral and written skills to do their dissertations.
SSS3: Students can manage their time to complete their dissertations.
SSS4: Students have the necessary skills to structure their dissertations.
<b>Supervisors' Technological Pedagogical Knowledge (TPK)</b> (Valtonen et al., 2017)
TPK1: I know how to use ICT in teaching as a tool for students' reflective thinking
TPK2: I know how to use ICT in teaching as a tool for students to plan their own learning
TPK3: I know how to use ICT in teaching as a tool for students' problem-solving in groups
TPK4: I know how to use ICT in teaching as a tool for students' critical thinking
<b>Section B</b>
<b>Educational Support (ES) and Motivational Support (MS)</b> (Strebel et al., 2019)
ES1: Supporting my students with the definition of specific, realistic goals was very important to me.
ES2: Supporting my students for the elaboration of a practical approach was very important to me.
ES3: Supporting my students with subject-specific knowledge was very important to me.
ES4: Supporting my students with the methodological approach was very important to me.
PS1: I used all the means possible to quickly react to my students' needs
PS2: I used all the means possible to constantly motivate my students.

### **Sample and Data Collection**

The data frame for the present study consisted of a list of the email addresses of all teachers who supervise UD in two Moroccan public HE institutions. This list was obtained after contacting the Human Resources departments in the two institutions. In the academic school year 2020-2021, the questionnaire was administered in two rounds. Before the allocation of students to supervisors, the latter were sent section A of the questionnaire to measure IS, SSS and TPK. This enabled the measurement of those constructs as initial conditions at the beginning of the supervision process. Section B was administered in late June, with clear instructions to participate only if the respondent did supervise UD students. Of the 300 participants randomly chosen from the initial data frame, 248 responded in the first round and 163 in the second round. 163 responses were therefore considered. Of these, 35 responses were removed because the respondents answered less than 50% of the total items. This left 128 responses. Following Hair et al. (2014), the sample size was adequate since it was 10 times higher than the number of arrows



pointing to a variable with the highest number of arrows (Figure 1). 38% of the respondents were female and 62% were male. By rank, Assistant Professors constituted 44% of the sample, Associate Professors 27%, and Senior Professors 29%.

## Results

### Reliability and Validity

Reliability and validity were tested using different measures. Items with loadings less than 0.600 were removed and the remaining items were retained for the subsequent analyses. Table 2 presents the loadings for the remaining items. Loadings greater than 0.600 mean good to very good reliability. Cronbach's alpha values were all greater than 0.700. The average variance extracted (AVE) values were all higher than 0.500 and all the values for Composite Reliability (CR) were higher than 0.700. This shows that all the items had good convergent validity (Hair et al., 2017). Discriminant validity was assessed using factor cross-loadings (Table 3), Fornell-Larcker Criterion and Heterotrait-Monotrait Ratio (HTMT) (Table 4). The cross-loadings on any other factor were smaller than the loadings for the factor and HTMT ratios were lower than the cut-off point of 0.8. Therefore, the items had good discriminant validity. Collinearity was checked using the Variance Inflation Factor (VIF) and all the VIF values were below the cut-off value of 5 and way below the cut-off value of 10 suggested by Pituch & Stevens (2016).

**Table 2**  
*Item Loadings, Reliability and Validity*

	$\Lambda$	VIF	Alpha	AVE	CR
IS2	0.887	2.773	0.803	0.707	0.876
IS3	0.953	2.606			
IS4	0.651	1.344			
SSS1	0.761	1.798	0.862	0.692	0.899
SSS2	0.737	1.750			
SSS3	0.935	2.462			
SSS4	0.878	2.667			
TPK1	0.847	2.697	0.908	0.784	0.935
TPK2	0.928	4.517			
TPK3	0.848	2.263			
TPK4	0.913	3.519			
ES1	0.886	2.227	0.843	0.761	0.905
ES3	0.926	2.655			
ES4	0.800	1.738			
PS1	0.875	1.625	0.766	0.808	0.894
PS2	0.923	1.625			

**Table 3**  
*Factor Cross-Loadings*

	<b>TPK</b>	<b>ES</b>	<b>IS</b>	<b>MS</b>	<b>SSS</b>
TPK 1	0.847	0.481	0.143	0.322	0.273
TPK 2	0.928	0.528	0.161	0.393	0.213
TPK3	0.848	0.467	0.199	0.428	0.096
TPK 4	0.913	0.514	0.222	0.459	0.212
ES1	0.488	0.886	0.348	0.589	-0.203
ES3	0.555	0.926	0.392	0.648	-0.204
ES4	0.413	0.800	0.307	0.463	-0.096
IS2	0.107	0.356	0.887	0.340	-0.347
IS3	0.246	0.396	0.953	0.361	-0.332
IS4	0.089	0.232	0.651	0.294	-0.242
MS1	0.375	0.556	0.273	0.875	-0.197
MS 2s	0.439	0.624	0.416	0.923	-0.321
SSS1	0.233	-0.105	-0.275	-0.136	0.761
SSS 2	0.186	-0.060	-0.086	-0.142	0.737
SSS 3	0.135	-0.273	-0.410	-0.361	0.935
SSS 4	0.280	-0.096	-0.298	-0.206	0.878

**Table 4**  
*HTMT Values and Fornell-Larcker Values*

	<b>IS</b>	<b>SSS</b>	<b>TPK</b>	<b>ES</b>	<b>MS</b>
IS	0.841	0.387	0.203	0.467	0.489
SSS	-0.362	0.832	0.282	-0.199	-0.295
TPK	0.207	0.222	0.885	0.562	0.456
ES	0.403	0.178	0.636	0.872	0.804
MS	0.391	0.302	0.539	0.658	0.899

*Note.* The diagonal values are the square roots of AVE. Above the diagonal values are the HTMT values and below are the correlations between the constructs.

### Descriptive Statistics

Table 5 gives the means for IS, supervisors TPK, SSS, ES and MS. Table 6 gives descriptive statistics of the type and level of support by the type of technological tool used. IS was lower than the mean value of 4 whereas the mean for ES was the highest. In addition, ES

was highest using LMS, followed by WA. Both ES and MS were systematically higher when a technological tool was used than when it was not.

**Table 5**  
*Descriptive Statistics*

	IS	TPK	SSS	ES	MS
Valid	127	119	122	122	125
Mean	2.723	4.706	4.201	5.464	4.588
SD	1.571	1.554	1.564	1.606	1.849
Min	1.000	1.000	1.000	1.000	1.000
Max	7.000	7.000	7.000	7.000	7.000

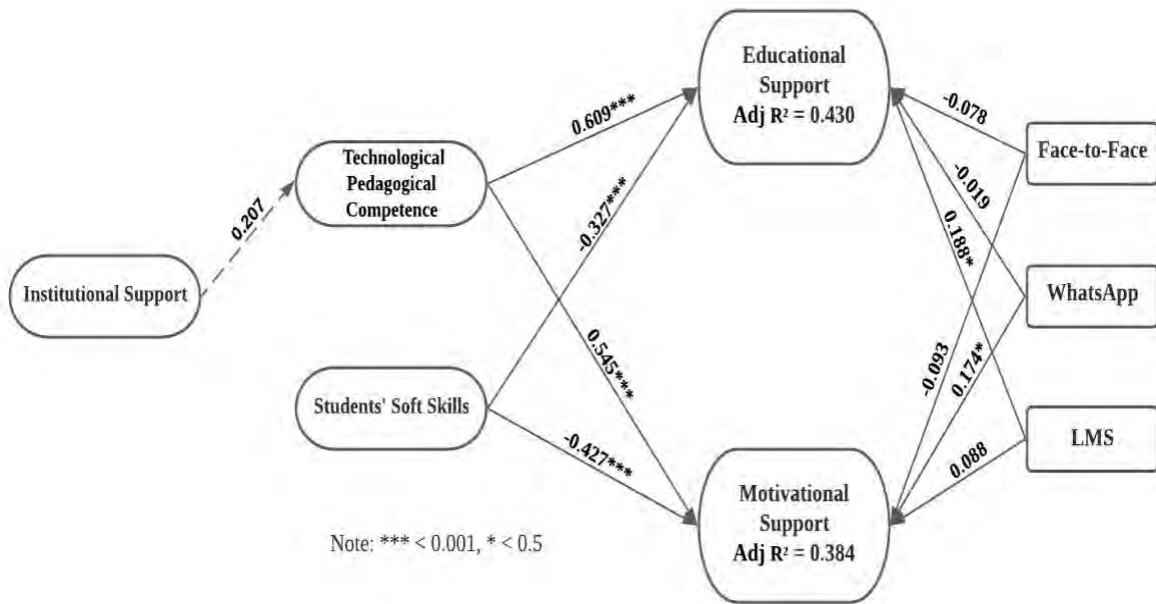
**Table 6**  
*Level of Support by Type of Technological Tool*

	Educational Support						Overall Sample
	F2F		WA		LMS		
	No	Yes	No	Yes	No	Yes	
Mean	4.986	5.783	5.478	5.383	4.921	6.185	5.464
SD	1.940	1.249	1.690	1.598	1.826	0.984	1.606
	Motivational Support						Overall Sample
	F2F		WA		LMS		
	No	Yes	No	Yes	No	Yes	
Mean	4.191	4.828	4.120	4.825	4.123	5.000	4.588
SD	2.156	1.515	1.936	1.803	2.029	1.491	1.849

### The Structural Model

Table 7 presents the path coefficients and the statistics related to each relationship. The results showed that supervisors TPK had a positive and significant effect on both ES ( $\beta = 0.609$ ,  $t = 9.092$ ,  $p < 0.001$ ) and MS ( $\beta = 0.545$ ,  $t = 7.512$ ,  $p < 0.001$ ). The null hypotheses H1a and H1b are therefore both rejected. Conversely, the effect of SSS on ES and MS is negative and significant ( $\beta = -0.327$ ,  $t = 4.696$ ,  $p < 0.001$ ) and ( $\beta = -0.427$ ,  $t = 6.059$ ,  $p < 0.001$ ) respectively. Therefore, H2a and H2b are both rejected and the alternative hypotheses are accepted. The categorical variables showed a mixed picture. The effect of F2F was significant on neither ES ( $\beta = -0.078$ ,  $t = 0.981$ ,  $p > 0.5$ ) nor MS ( $\beta = -0.093$ ,  $t = 1.127$ ,  $p > 0.05$ ) respectively. For technological tools, the results are varied since there is a positive and significant effect of WA on MS ( $\beta = 0.174$ ,  $t = 2.360$ ,  $p = 0.018$ ), but its effect on ES is not significant ( $\beta = -0.019$ ,  $t = 0.278$ ,  $p > 0.5$ ). Just the opposite is true for LMS. Whereas its impact on MS is not significant ( $\beta = 0.088$ ,  $t = 1.136$ ,  $p > 0.5$ ), its impact on ES is positive and significant ( $\beta = 1.188$ ,  $t = 2.551$ ,  $p = 0.011$ ). IS had a positive impact on supervisors' TPK ( $\beta = 0.207$ ,  $t = 1.995$ ,  $p = 0.046$ ). Using a 95%, bias-corrected confidence interval showed, however, that its effect is not significant (Table 7). Figure 2 summarizes the path coefficients and provides the variance explained by the exogenous variables (Adjusted  $R^2$ ).

**Figure 2**  
*Path Coefficients and Adjusted R<sup>2</sup>*



**Table 7**  
*Constructs Relationships and Bias-Corrected Intervals (Hypotheses H1a to H5b)*

	<b>B</b>	<b>T</b>	<b>P</b>	<b>2.5%</b>	<b>95.5%</b>
H1a: TPK → ES	0.609	9.092	0.000	0.463	0.724
H1b: TPK → MS	0.545	7.512	0.000	0.393	0.674
H2a: SSS → ES	-0.327	4.696	0.000	-0.447	-0.184
H2b: SSS → PS	-0.427	6.059	0.000	-0.544	-0.280
H3a: F2F → ES	-0.078	0.981	0.327	-0.236	0.078
H3b: F2F → MS	-0.093	1.127	0.260	-0.245	0.077
H4a: WA → ES	-0.019	0.278	0.781	-0.153	0.116
H4b: WA → MS	0.174	2.360	0.018	0.027	0.317
H5a: LMS → ES	0.188	2.551	0.011	0.041	0.329
H5b: LMS → MS	0.088	1.136	0.256	-0.068	0.236
IS → TC	0.207	1.995	0.046	-0.272	0.325

## Discussion

The present study examined the effect of supervisors' TPK and supervisors' perception of students' soft skills and technological tools on UD supervisors' educational and motivational support for students. In the context of web-facilitated teaching, the findings show that as supervisors' TPK increases, their level of support increases. This finding is in agreement with the literature suggesting that increased TPACK better informs teaching decisions and leads to effective measures taken by supervisors to increase the quality of supervisor-student relationships and foster student-centered learning (Ouyang & Scharber, 2018; Tai et al., 2015). On the other hand, the findings also reveal that supervisors' perception of students' soft skills negatively affects their level of support. This suggests that UD supervisors lean more toward a "laissez-faire" approach if they trust students can complete the dissertation with minimal interference. The result lends support to Deuchar's (2008) discussion of the interaction between students' style (autonomous vs. dependent) and supervisors' style (hands-on vs. hands-off) in postgraduate supervision and the resultant supervision styles that emerge based on supervisors' assumptions about the educational and affiliation needs of their students. One difference is that where supervisors in postgraduate can adjust their assumptions and styles given the time they have, UD supervisors face the dilemma of having to make quick decisions (Vehviläinen & Löfström, 2016). In short, supervisors ration the scarce resources they have and distribute them according to not just students' needs (Agricola et al., 2020), but also their perception of what those needs are.

For technological tools, the use WhatsApp® was found to significantly increase motivational support and the use of LMS educational support. The results agree with findings indicating that social media in general allows for increased interactivity (Sun et al., 2018). As mentioned above, dos Santos and Cechinel (2019) suggested that synchronous tools are conducive to non-academic tasks and facilitate social support while LMS, a platform specifically designed for online education, is optimized for task-oriented activities. In general, the use of technological tools can be seen as one way to strengthen communication between students and supervisors and tallies well with theories of teacher presence and online communities (Tang & Hew, 2020).

Lastly, institutional support had no significant effect on supervisors' TPK. While the result was not expected given the large body of evidence suggesting the positive impact of institutional support on teaching quality (Hénard, 2010; Zuvic-Butorac & Nebic, 2009), there is also evidence that top-down support is likely to result in supervisors resisting change (Mårtensson et al., 2011). An equally plausible explanation is that institutional support that is not task-specific, i.e. that targets a specific activity like supervision, is not useful even if present. This generally corroborates Maor and Currie's (2017) claim that supervision is different from teaching. In any case, the mean of institutional support is way below average, suggesting the absence of institutional support as such or the absence of its impact on supervisors' practices.

## Implications, Limitations and Future Work

Prior work on UD supervision examined supervisors' support as an input factor, but the present study investigated supervisors' support as the outcome of various contextual factors. Supervisors' TPK and their perception of students' soft skills were found to affect the educational and motivational support students receive. In theory, then, the result points to the relevance of TPK and the TPACK model in general for the task of UD supervision. TPACK has preponderantly been adapted to study classroom practices, but its role in UD is unknown. The

adaptation of the TPACK model for UD supervision is certainly a thread to follow in the future. Furthermore, future work needs to address the way teachers' knowledge interacts with that of students in shaping teaching practices in general and supervision in particular. This area is largely under-researched (Vermunt & Verloop, 1999).

In addition, the present study contributes to the existing scholarship on the use of technology in educational settings (Sloan et al., 2014; Sun et al., 2018). It confirms general trends observed in previous work, but general trends are unlikely to tell the whole story. Theories of online learning emphasize the role of online communities in the social construction of knowledge (Akyol & Garrison, 2008); this is likely to be true for LMS as well as social media, although the latter is less acknowledged as an educational tool. Future work can, therefore, examine the co-construction of knowledge in social media using appropriate frameworks.

Among the various limitations that the present study has, the absence of other relevant factors and/or mediators stands out. Several other variables are known to affect the choice of technological tools and their determinants (Ouajdouni et al., 2021). Similarly, several studies have examined the mediating role of technology anxiety in LMS use (Alkhawaja et al., 2021). These and many other contextual variables—number of students, workload, and attitude towards supervision (Zeddari, 2018)—could affect the role of the supervisor and should certainly be taken into consideration for a more in-depth understanding of UD supervision.

The generalizability of the findings from the study is limited by the relatively small size sample from only two public institutions. Multigroup comparisons across different institutions, private and public for example, are necessary to better understand the role of institutional variables in the process of UD supervision. Also, it is plausible that UD supervision is subject to cultural differences, be it in the choice of the tools to use, the type of support to give and the ways to give it. For example, the preference for WeChat in China and Apple apps in the United States may impact the type of level of support UD supervisors provide (Sun et al., 2018; Minocha & Petre, 2012). Future work needs to examine UD supervision and its contextual determinants across different institutions and cultures.

## Conclusion

The present work has examined some factors that affect UD supervisors' level of support. In particular, supervisors' degree of educational and motivational support is affected by their perception of students' soft skills, their TPK, and the technological tools they use. The higher the TPK of supervisors is, the higher their level of support, but such support is also inversely conditioned by what supervisors believe students can do on their own. In addition, it was found that technological means were not created equal. Supervisors who used social media reported a higher level of motivational support, whereas supervisors who used an LMS reported a higher level of educational support. The study points to the important links existing between technology, pedagogy, soft skills, and UD supervision.

### Declarations

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