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WhatsApp for mobile learning. Effects on knowledge, resilience and isolation in the school-to-work transition

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ABSTRACT

This study investigated the use of instant messaging in the school-to-work transition, a crucial stage of learning and development. Newly graduated health professionals (n = 235) participated either in WhatsApp groups in which moderators shared knowledge and facilitated professional discussions or in the control group. The results show that participants in the WhatsApp groups had markedly higher levels of knowledge, greater resilience as well as lower levels of professional isolation– in comparison with the control group. They also reported less stress when searching for a new job. These findings are affirmed by the qualitative analysis of open survey questions: knowledge acquisition emerged as the main benefit followed by connectedness and professional informational benefits. A further interesting result is that the general, day-to-day use of WhatsApp outside of the intervention was linked to higher levels of resilience.

Another finding is that although the actual (measured) and self-reported frequency of participation in the WhatsApp groups correlated highly, these measures did not predict the outcome variables in the regression analysis. This observation questions the frequency of participation as a proxy for the success of engagement.

1. Introduction and literature review

1.1. Transition: deficiencies in "knowing" and "becoming" as key stressors

Transitioning is conceived as the processes of change between one previously established context and another. This transformation involves the disruption of established norms, roles, identities, expectations and social relationships, and the adaptation to new ones, which is accompanied by increased levels of stress (Mikal, Rice, Abeyta, & DeVilbiss, 2013). A central transition that most individuals pursue is the journey from education to work. Importantly, this journey is not seen as the confined time between the end of school and the first day of work. Instead, it comprises the longer practices of approximation and adaptation which start already at school, for example in the form of practice placements, and they reach into the initial phases of work. The present study focuses on the later parts of this trajectory, i.e. on graduates' transition from the completion of their school into the initial phases of their work life. Although this phase harbours manifold opportunities for lifelong learning and professional development, for many it is a daunting experience during which many obstacles need to be overcome (Wendlandt & Rochlen, 2008). This is certainly true for health professional education, the domain of the present study that puts new nurse graduates in the centre of the analysis. Nurse graduates conceive the immersion in the world of work as instructive and developmental but highly challenging at the same time (Wangensteen, Johansson, & Nordström, 2008). They tend to struggle with two broad aspects: (1) knowledge and skill-related issues and (2) socio-cultural and socio-professional issues related to the processes of "becoming a professional", as outlined in the following sections.

With attention to the first aspect, many new nurse graduates worry, for example, about deficiencies in knowledge and skills described for

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example as "not knowing" (Clark & Springer, 2012) and many feel-ill prepared for practice (Casey, Fink, Krugman, & Propst, 2004; Fink, Krugman, Casey, & Goode, 2008). Reported knowledge gaps include a lack of clinical and technical skills and of critical thinking and communication skills which amount to what is perceived as an overall low readiness for practice (Missen, McKenna, & Beauchamp, 2016).

The second main challenge is sociocultural in nature and can be conceptualised using the learning-as-participation metaphor, which puts the processes of "becoming a professional" in the foreground (Sfard, 1998). Graduates who are taken away from the familiar territory of education (Fink et al., 2008) and who do not yet feel accepted in the new professional environment experience high levels of professional isolation (Evans, Boxer, & Sanber, 2008). Referring to the concepts of Lave and Wenger (1991), the limited extent of professional integration, identification and belonging (Fink et al., 2008; McKenna & Newton, 2008) make these nurses *peripheral* instead of *central* members of their respective professional communities.

The perceived knowledge gaps and the restricted professional participation contribute to the high levels of stress that many graduates experience (Casey et al., 2004; Fink et al., 2008). Against this backdrop, the relevance of the concept of resilience, i.e. the ability of people to deal with and positively adapt to new and stressful situations (Campbell-Sills & Stein, 2007) is a central construct. In other words, the successful management of and adaptation to challenging and stressful situations is a key route of learning and development (Wangensteen et al., 2008) and, at the same time, resilience shapes new graduates' transition into the workforce (Wahab, Mordiffi, Ang, & Lopez, 2017).

Transition programmes in which graduates are supported in their immersion into the world of work were found to be effective, particularly if they included mentoring support and structured didactic content (Cochran, 2017). They were found to promote professional growth and reduce attrition (Cochran, 2017; Reem, Kitsantas, & Maddox, 2014). However, there is a lack of empirical studies that examine how these programmes can be implemented using digital media, and instant messaging platforms in particular, which motivated the development of this paper.

1.2. Instant messaging, learning and professional development

The underlying proposition of this research was that mobile instant messaging (MIM) can be used to effectively support learners, i.e., new graduates, in transitioning into their jobs. Mobile Instant Messaging is one of, if not the most popular group of social media applications, with WhatsApp, Facebook Messenger and WeChat attracting more than 3.8 billion active users (Statista, 2019). In Nigeria, the context of this study, WhatsApp presents the most popular social network with a 41% penetration rate (Clement, 2019). In view of these numbers, there is still relatively little known about its role in education. A first review has identified several ways in which MIM has been incorporated in education settings. These include the use of MIM for self-reflection, dialogic forms of learning, direct instruction, constructionist activities in which learners produce text in a collaborative fashion, and assessment (Tang & Hew, 2017, p. 85).

The capability of mobile instant messaging to support the development of a social and socioemotional learning presence are evident, backed by an emerging corpus of quantitative and qualitative studies (e.g. Kim, Lee, & Kim, 2014; Pimmer et al., 2019; Pimmer, Daniels, Ologun-Abiodun, & Chipps, 2019; Robinson et al., 2015). For example, the development of togetherness was found to be one of the key affordances of MIM, particularly in comparison with social network sites (Karapanos, Teixeira, & Gouveia, 2016). This was also affirmed in an experimental study that compared the use of mobile instant messaging with that of *non-mobile* instant messaging and of a bulletin board: learners who used mobile instant messaging for collaborative learning highlighted emotional proximity as a key aspect (Kim et al., 2014). The capacity of instant messaging to foster togetherness is grounded in the communicative nature of this medium which permits users to develop and maintain a sense of connection and community (Church & de Oliveira, 2013; Nardi, Whittaker, & Bradner, 2000). In their study on WhatsApp, O'Hara, Massimi, Harper, Rubens, and Morris (2014) aptly conceptualise how togetherness and intimacy are co-constructed through "*small, continuous traces of narrative, of tellings and tidbits, noticings and thoughts, shared images and lingering pauses*", sometimes without an immediate sense of purpose, which they view as a constitutive element of dwelling. Examined in the context of the present study, health professional education, it was found that the use of WhatsApp promotes a social learning presence in a problem-based learning setting (Robinson et al., 2015) and it also contributes to the co-construction of proximity among interactants (Pimmer, Daniels, et al., 2019).

In contrast to enabling a socio-emotional presence, MIM's capacity to support cognitive learning outcomes (i.e. gains in knowledge and skills) is less evident and not well understood to date following systematic reviews (Pimmer & Rambe, 2018; Tang & Hew, 2017). Of the seven experimental studies in the systematic review that measured knowledge gains (Tang & Hew, 2017), two reported null or even adverse effects. Among the five studies that found positive results, three were from the domain of language learning, which is a particular subset of educational technology studies. One study suggests that mobile instant messaging is less conducive to supporting intellective engagement than other forms of digital media use (Kim et al., 2014). In detail, the instant messaging groups had lower levels of cognitive and metacognitive interactions compared with collaborative learning on bulletin boards (Kim et al., 2014).

Tang and Hew (2017) propose that it is the modality and frequency of instant messaging that impact on learning gains. They underpin their arguments with the quasi-experimental study of Lai (2016). Whereas the WhatsApp groups did not achieve higher levels of vocabulary retention than the control group, a correlation between learning outcomes and the frequency of contributing (i.e. the modality of writing) within the WhatsApp group condition was found. This pattern was confirmed by a study of Pimmer et al. (2019) that, similarly to the present one, examined the use of moderated WhatsApp groups to support health professionals' school-to-work transition. The effects of higher knowledge and lower levels of isolation between intervention and control group were even more pronounced when the WhatsApp group was controlled for active participation, i.e. the frequency of writing contributions (Pimmer et al., 2019). However, a shortcoming in this approach was that the WhatsApp contributions were self-reported and not objectively measured.

1.3. Instant messaging in school-to-work transitions

The idea of using MIM in the school-to-work transition can be linked to the theoretical arguments of Mikal et al. (2013). Drawing on a literature review they posit that, in transitions, computer-mediated support can alleviate the effects of transitional stress by maintaining existing relationships and providing informational, instrumental and socio-emotional support (Mikal et al., 2013). However, the systematic use of digital media in school-to-work transition programmes and its empirical analysis are very rare. For example, systematic reviews from the health professional domain made no mention of this opportunity (Reem et al., 2014; Rush, Adamack, Gordon, Lilly, & Janke, 2013) and the broad review of computer-mediated transition support did not identify any study in the school-to-work transition context (Mikal et al., 2013). In their selective review, Webster, Jenkins, Oyebode, Bentham, and Smythe (2019) explicitly highlight the need for research to examine online transition support. The scarcity of research is also in evidence with attention to the use of instant messaging. Except for the above study, in which graduates' participation in moderated WhatsApp groups resulted in enhanced knowledge and reduced feelings of isolation (Pimmer et al., 2019), we could identify only a few other studies on the use and effects of instant messaging in school-to-work transitions. In one

study from South Africa, new nurse graduates took part in a WhatsApp group-based transition programme (similar to the intervention reported in this paper) that included topics such as conflict, stress, and career management. Within the eight-week intervention the participants had a significant increase in bridging and bonding social capital with peers, professional integration and their sense of being part of a community of practice, as measured through pre- and post-tests (Chipps, Ologun-Abiodun, Daniels, & Pimmer, 2020). The qualitative analysis of the same intervention suggests that positive effects were not only triggered through moderators, but also by re-connecting relatable social ties, i.e., former students who experienced very similar situations, and providing these spatially, socio-culturally and often emotionally 'dislocated' graduates a provisional space to belong (Pimmer, Daniels, et al., 2019). For graduates, the use of instant messaging also presents a relevant channel for information and learning outside of formally established and systematically managed and moderated interventions, as the study of Shenouda, Davies, and Haq (2018) suggests. Newly graduated junior doctors informally adopted WhatsApp for the coordination of clinical work and for the realisation of teaching sessions and informal learning opportunities (Shenouda et al., 2018). A further study by Sigalit, Sivia, and Michal (2017) about placement learning found that the informal use of social media including MIM was positively associated with students' resilience. This connection was interpreted as the affordances of technology in supporting the maintenance of students' social bonds with peers which could be activated in stressful moments in the new workplace (Sigalit et al., 2017).

1.4. Objectives and research questions

Against the background of the literature review and the gaps identified, three main research questions were developed:

1) Does the use of the moderated MIM groups impact the indicators of (a) knowledge score, (b) perceived knowledge transfer, (c) professional isolation, (d) resilience, (f) stress during job search and (g) stress at the beginning of the new job - as compared with a control group? And if so, to what extent?
2) What are the central benefits of participating in the instant messaging groups – as perceived by the users?
3) Does the frequency with which participants write and read messages in the WhatsApp groups predict the above outcome indicators (e.g. knowledge)?

2. Material and methods

2.1. Study context, design and sampling

This study was part of a larger, multinational research programme that investigated the use of mobile and social media to support health professionals and was funded by r4d programme of the Swiss National Science Foundation and the Swiss Agency for Development and Cooperation (IZ07ZO_160910). With the goal of addressing the research questions stated above, a two-arm, post-test between-subjects experimental design was employed in Nigeria. A graphical overview of the entire process is presented in Fig. 1. In the first arm, the intervention group, participants took part in moderated WhatsApp groups for a period of six months. The second group served as the control condition, where participants did not take part in the moderated WhatsApp group.

The sampling and recruitment process was organised in the following way: The sample consisted of students from eight nurse training institutions in Nigeria, who were recruited before graduation via onsite visits by members of the research team. In the recruitment process, prospective participants were informed about the goal and scope of the project. In this process, written informed consent was obtained from the

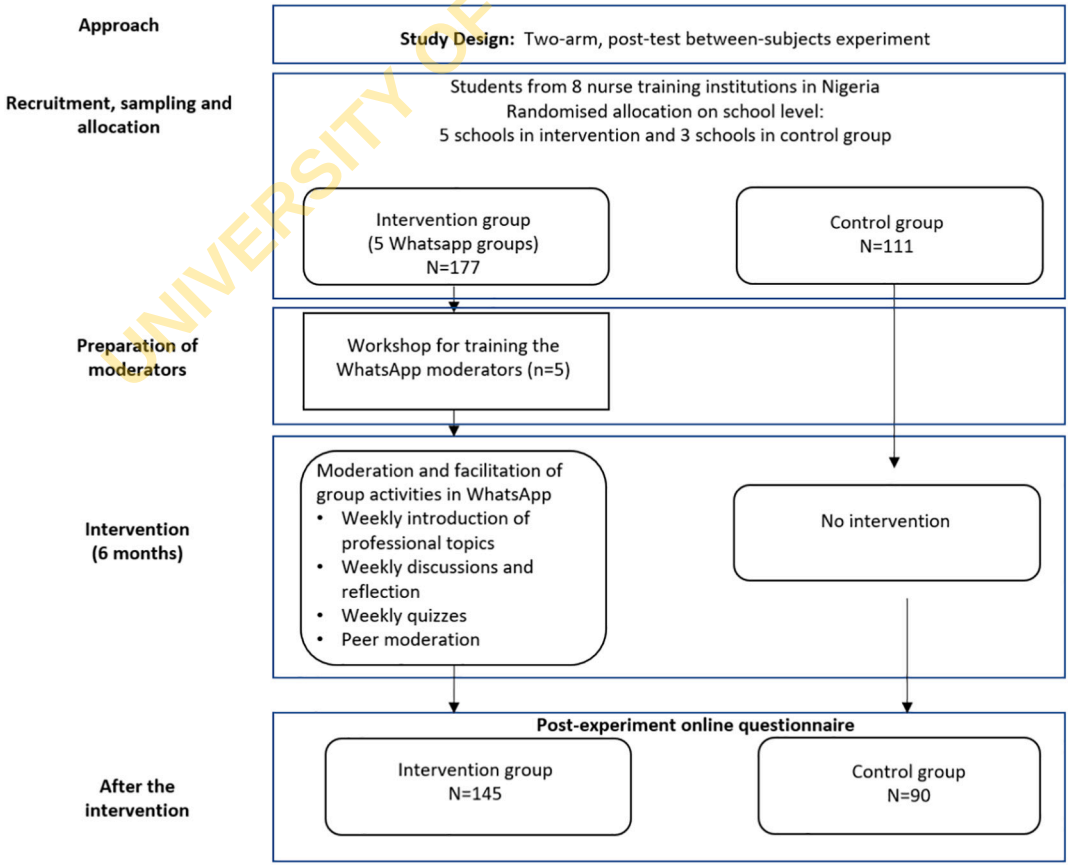

Fig. 1. Overview of experimental process.

participants (see the section below for "ethical consent"). Moreover, participants who consented to the study also provided their mobile phone numbers. These numbers were used to invite graduates from the intervention condition in the WhatsApp groups and to provide graduates from both groups with the link to the survey. Out of eight pre-selected schools, five schools (with 177 participants) were assigned to the intervention condition and three schools (with 111 participants) to the control condition. The randomised allocation to the intervention and control group was performed on a school level and not on an individual level to involve intact social units. Allowing graduates to benefit from pre-existing social connections was a deliberate measure grounded in previous literature (Boyd & Ellison, 2007; Ellison, Steinfield, & Lampe, 2007). We allocated more schools and, consequently, more participants to the intervention group to account for persons who might not be able to participate due to various reasons including the lack of a WhatsApp-enabled phone, a lack of airtime or any other challenge that would potentially prevent them from participating in the six-month intervention. However, the dropout was small and very similar in both groups: out of the 177 participants from the intervention group who expressed their initial interest, 145 participated in the final survey; out of the 111 students from the control group, 90 participated in the final survey. On this basis we calculated the response rate of 82% for the intervention group and of 81% for the control group. Importantly, for some survey questions the response rate was lower, as the response to each question was voluntary (participants could skip questions) and some of the questions could only be answered by participants who had already started a new job, as detailed in the respective methodological sections.

For the moderation and facilitation of WhatsApp group activities, five moderators were recruited and trained in an onsite workshop organised by the research team. All moderators were experienced nurse professionals who were between 23 and 47 years old. The preparatory training lasted four hours and involved instructions and discussions about how to teach topics on WhatsApp and how to promote graduates' active participation in the WhatsApp groups, for example by acknowledging and reacting to participants' comments and questions in a prompt manner. The moderators also received a digital script, which had been developed by the research team. The script included general moderation and facilitation guidelines as well as two categories of topics that were deemed to be of particular relevance for new graduates. The first category included professional topics, such as career planning. The second category consisted of practical clinical knowledge, such as the management of communicable diseases. The clinical content was not novel but was mostly a repetition of key knowledge that participants had learned before in their schools - in the sense of a refresher course.

The intervention was initiated in December 2017 and lasted for six months. Each week was dedicated to a new topic, which was introduced by the moderator at the beginning of the week. The moderator presented the key facts and instructions and invited participants to contribute with and reflect on their personal experience with respect to the topic presented. At the end of the week, each topic was concluded with a quiz labelled "fastest finger". The moderator posted a question and the first respondent who provided the correct answer received a prize in the form of data bundles (airtime). This competitive but friendly and voluntary activity can be viewed as an element of gamification (Kiryakova, Angelova, & Yordanova, 2014) with the goal of encouraging graduates' active participation. Other than via the quiz, participants did not receive any financial compensation for their participation in the group chat. This also means that they used their own data bundles to participate. In addition to pre-defined content and scheduled activities, the moderators also encouraged and contributed to discussions that emerged in flux.

The first four weeks of the intervention were moderated exclusively by the trained moderators. For the remaining five months, group members nominated a graduate peer who acted as a moderator on a weekly basis. The co-moderators performed various tasks, including the sharing of the predefined content, encouraging participation, and paying out winners of the fastest finger competition. The goal of the use of graduate co-moderators was to increase the level of ownership, unburden the trained moderators and to enhance the sustainability of the intervention. The language used was English because it is the official language of the country and English is also used in the contexts of health and education.

2.2. Data collection and analysis

The data collection instrument was an online survey using the survey monkey platform. Participants in the intervention condition were prompted to fill in the survey via the WhatsApp groups, and WhatsApp was also used to reach out to participants of the control group. Each participant who took part in the survey was incentivised with an airtime credit of N500 (about USD 1.2). The questions addressed information on participants' socio-demographic and professional backgrounds and their professional experience. The survey also included a quiz to test graduates' clinical knowledge. One open question was added for the participants in the intervention condition with the goal of eliciting their perception on the benefits of participating in the WhatsApp group, using the following prompt: "Please describe the most important thing you gained from participating in the moderated WhatsApp".

All statistical calculations were carried out using R Software, version 3.5.3. The quantitative measures are presented in the following section and the detailed questions can be found in the appendix. Unless stated differently, all questions were evaluated on a six-point Likert scale with the items "strongly disagree", "disagree", "somewhat disagree", "somewhat agree", "agree", strongly agree". **Resilience**, i.e., an individual's positive adaptation in situations of stress, was measured using the 10-item scale of Campbell-Sills and Stein (2007). The research team slightly modified items 3 and 9 to adapt them to the cultural specificities of the research context. The scale showed acceptable internal consistency (α =0.71, 95% CI α[0.66, 0.77]) and reliability (McDonald's ω_t = 0.80). **Professional isolation** was measured using four items from Russel, Peplau, and Cutrona (1980), which were adapted to the research context. The resultant Cronbach's alpha suggests a good internal consistency (α =0.83, 95% CI α[0.8, 0.87]) and omega total good reliability (ω_t = 0.88).

In measuring **stress** we followed the established practice of using a single-item indicator (Pinquart, Juang, & Silbereisen, 2003), which captured the level of stress that graduates had while searching for a new job. In addition, we added one item that measured the level of stress that participants' experienced after they started their new job. In the tables of this study these two items are shortened to **stress job search** and **stress job begin.**

The participants' **knowledge score** was assessed with 14 multiple-choice questions that focused on some of the clinical topics which had been discussed in the WhatsApp groups. The following question is an example: "Which of the following is the antibiotic of choice* for meningitis?" (A) Cefaclor, (B) Ciprofloxacin, (C) Ceftazidime or (D) Ceftriaxone. *The knowledge score was calculated drawing on an established procedure (e.g.* Haque, Rahman, Itsuko, Mutahara, & Sakisaka, 2014), in which all correct answers were credited with one point and wrong or missing answers received zero points. The maximum knowledge score that a participant could achieve was thus 14 points.

Knowledge transfer, i.e., the extent to which the participants' described the application of knowledge gained from their schools in their day-to-day work, was measured using a shortened version of Xiao's (1996) training transfer scale, which was adapted to cover the transfer of training knowledge to the workplace in the context under investigation. The four items measured the frequency and ease of transfer and the extent to which this knowledge helped graduates in tackling daily work tasks. Cronbach's alpha of the four items was 0.67 (95% CI α[0.60, 0.74]) and consistency could not be improved by dropping items. However, McDonald's omega showed an acceptable reliability (ω_t = 0.73).

2.2.1. Self-reported participation in the WhatsApp groups

The participation in the WhatsApp groups was measured in various ways. For the intervention condition, we measured self-reported and the actual participation in the moderated WhatsApp groups. Drawing on the differentiation used by Cho (2014), we differentiated modalities of participation, i.e. reading and writing. More precisely, for the **reported WhatsApp use** participants indicated the extent to which they have written and read contributions in their respective WhatsApp groups. This was captured through the variables **WA writing (reported)**, and **WA reading (reported).**

2.2.2. Actual participation in the WhatsApp groups (written contributions)

In addition to self-reported measures, we also determined the number of all written contributions (messages) that each participant in the intervention group has written during the intervention. This was captured with the variable **WA writing (actual).** This variable was calculated based on the extracted WhatsApp conversation protocols. To account for the markedly skewed distribution of these values, the log of these numbers was taken.

2.2.3. General WhatsApp use (GWA)

The above WhatsApp measures were exclusively taken from the intervention group as only participants from this condition were invited to take part in the moderated WhatsApp groups. However, we additionally measured the general (reported) WhatsApp use of all participants (from the intervention and the control group), i.e. their day-to-day use of WhatsApp outside of the study. To do so, we again differentiated the modalities of reading and writing (Cho, 2014), with the variables **GWA writing (reported)** and **GWA reading (reported)**. In addition, we combined (averaged) these two measures and labelled it **GWA averaged (reported).**

2.2.4. Qualitative analysis

Participants' responses to the open survey question were extracted and imported into Nvivo Software for qualitative analysis. The analysis was carried out using inductive category formation, which is a method of qualitative content analysis (Mayring, 2000, 2004). The level of abstraction was pre-defined by the survey question focusing on the perceived key benefits. In the first round, the data were read and re-read, and on this basis, the emerging subcategories were developed and revised iteratively and grouped into main categories by two researchers, using about 70% of the data. Then, once the final coding scheme was developed, all data were processed (Mayring, 2004).

2.3. Ethical considerations

The Institutional Review Board (IRB) of the University of Ibadan/University College Hospital approved the protocol of the study. In addition, the research team obtained permission from the administrators of each school before visiting the sites. At each school, members of the research team met with students a few weeks before their graduation and informed them about the study. They emphasised the voluntary nature of participation and highlighted that the data would be kept and presented in a confidential manner so that no linkages could be made to individual participants. After this process, written informed consent was obtained from the participants.

3. Results

3.1. Sample

Of the total number of 235 participants that participated in the final survey (M_{age} = 23.32, SD = 2.98, range = 19–37, 33 male and 202 female), 145 were from the intervention group and 90 from the control group (see Table 1). Seventy-nine percent (n = 185) of the participants had already started a new job and had been working for an average of 4.44 months (SD = 1.97). The survey software also allowed participants who had not found a job to answer questions that only made sense for those who already had started to work. These included work area, knowledge transfer, professional isolation, and stress at job begin. Accordingly, answers from participants without a job were excluded for the analysis of the aforementioned job-related variables.

Intervention and control groups were comparable (Table 1). In detail, no significant differences between the intervention and control condition were observed in terms of age (t(220.03) = −0.79182; p = .429; g = −0.100; 95% CI g[−0.365, 0.165]) gender ($X^2(1, N = 235)$ = 0.1933; p = .66) and the number of months they worked after graduation (t(144) = 1.1645; p = .246; g = 0.176; 95% CI g[−0.125, 0.477]) using Welch's t-test.

Study participants were frequent WhatsApp users with 94% (n = 209 of 222 answers to this question) accessing the platform at least daily. The reported general WhatsApp use, i.e. the day-to-day use did not differ significantly between intervention and control group, neither concerning the frequency of writing (t(199.7) = 1.1819; p = .239; g = 0.159; 95% CI g[−0.111, 0.428]) nor reading (t(177.94) = −0.9923; p = .322; g = −0.138; 95% CI g[−0.407, 0.132]) nor the mean of both (t(192.01) = 0.2054; p = .838; g = −0.028; 95% CI g[−0.241, 0.297]). There were significant differences with regard to the work area, $X^2(3, N = 185)$ = 8.5602; p = .036,however, the observed frequencies in rural (in or around a small village) and peri-urban areas (in or around a larger village) were very low with only seven participants working in rural areas (one in the intervention condition). Therefore, these two categories were collapsed (see Table 2) and labelled "rural". The chi-squared test on work area with three levels (rural, agglomeration, urban)

Table 1
Descriptive statistics and statistical tests of the demographic variables.

	Total				Control			Intervention							
	N	M	SD	n	M	SD	Mdn	n	M	SD	Mdn	t	p	g	95% CI g [LL, UL]
Age	234	23.32	2.984	89	23.13	2.505	22	145	23.43	3.246	22	−0.792	0.429	−0.100	[−0.365,0.165]
Months working	183	4.44	1.974	68	4.66	1.936	5	115	4.31	1.993	5	1.165	0.246	0.176	[−0.125,0.477]
General WhatsApp use (GWA)															
Writing	222	4.48	1.310	89	4.61	1.240	5	133	4.40	1.354	5	1.182	0.239	0.159	[−0.111,0.428]
Reading	222	4.79	1.107	89	4.70	1.162	5	133	4.85	1.070	5	−0.992	0.322	−0.138	[−0.407,0.132]
Averaged	222	4.64	0.985	89	4.65	0.972	5	133	4.62	0.997	5	0.205	0.838	0.028	[−0.241,0.297]
	N	%		n	%			n	%			X^2	p	φ	95% CI φ [LL, UL]
Gender															
Female	202	86		79	88			123	85			0.193	0.660	0.04	[0.00, 0.17]
Male	33	14		11	12			22	15						

A significant p-value indicates that the corresponding Welch's t-test or Chi-squared was significant. g represents Hedges' measure of effect size. φ represents the effect size for Chi- squared tests. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. Differences in the number of observations are due to missing values in the questionnaire. *Indicates $p < .05$. **Indicates $p < .01$. ***Indicates $p < .001$.

Table 2
Frequencies of different work areas of the participants who already had a job.

Work area	Control	Intervention	Total	
Rural (in and around villages)	9	6	15	(8.1%)
Township (close to a town)	9	11	20	(10.8%)
Urban (in a town)	50	100	150	(81.1%)
Total		68	117	185

revealed no significant differences between the intervention and control conditions, $X^2(2, N = 185) = 4.8269$; $p = .090$.

3.2. Comparison of intervention and control group (RQ1)

Addressing RQ1, we compared the intervention group with the control group for differences in the outcome indicators (see Table 3). Most of the measures were not normally distributed, thus Welch's *t*-test and Wilcoxon signed-rank tests were applied using the significance level of $\alpha = .05$. Both tests yielded the same results for all variables. For simplicity and consistency, only the results of the Welch's *t*-tests are reported here (see Appendix B for details on the robust statistical tests). The greatest difference was found regarding the knowledge score, which was measured through online tests. Participants in the WhatsApp groups (M = 7.31, Mdn = 7) had markedly higher knowledge scores than the control group (M = 5.72, Mdn = 5), and this difference was significant, t(210.40) = −5.9540; $p < .001$; g = −0.782; 95% CI g[−1.065, −0.500]. In contrast, the self-perceived measure of knowledge transfer, i.e., the extent to which participants agreed that they applied knowledge from school to the workplace, did not differ between the intervention and control group (Table 3).

Positive effects were also found with attention to the sociocultural and socioprofessional measures. Participants in the WhatsApp groups had significantly greater resilience, lower levels of professional isolation, and less stress during the phase of job search than the control group. In detail, resilience levels were significantly higher in the intervention group (M = 5.06, Mdn = 5.1) compared to the control group (M = 4.89, Mdn = 5.0) t(124.34) = −2.355; $p < .05$; g = −0.306; 95% CI g [0.035, 0.576], which indicates that the nurses in the WhatsApp group found it slightly easier to cope with more stressful situations. The sense of professional isolation, i.e., the participants' detachment from other nurses, was significantly lower in the intervention group (M = 2.05, Mdn = 2) than in the control group (M = 2.47, Mdn = 2) t(111.75) = 2.861; $p < .01$; g = 0.474; 95% CI g[0.164, 0.784]. In the same way, the stress that the participants experienced in the phase of job search was lower in the intervention group (M = 4.23, Mdn = 5) than in the control group (M = 4.7, Mdn = 5) t(204.31) = 2.298; $p < .05$; g = 0.306; 95% CI g[0.035, 0.576]. Although the level of stress at the beginning of a new job was also lower in the intervention group (M = 3.9, Mdn = 4) than in the control group (M = 4.03, Mdn = 5), the differences were not statistically significant.

3.3. Benefits of WhatsApp group participation (qualitative analysis, RQ2)

This section summarises the key benefits that the study participants indicated having obtained through their participation in the WhatsApp groups. Table 4 gives an overview on the categories of perceived benefits identified in the qualitative analysis of participant statements ($n = 138$) made in response to the open question in the post-experiment questionnaire. The qualitative findings affirm the quantitative results insofar as the vast majority of the comments ($n = 85$) related explicitly to learning and knowledge gain (see Table 4), and some other relevant but less dominant categories emerged around connectedness and professional information:

3.3.1. Cognitive: acquisition and repetition of practical knowledge

In addition to some general remarks, the participants highlighted clinical knowledge and skills that were enhanced through the participation including, for example, pain management, emergency health care, communicable diseases. Some indicated a practice impact in that it supported their delivery of health care services: "*It helped me with emergency health care provision*". The participants were appreciative of both learning new things and reviewing "old" school knowledge i.e., "*refresh and recall what I have learnt in the past.*" Some also noted that group participation advanced their knowledge of topics they had poorly understood in school.

Table 4
Benefits that nurses associated with their participation in the WhatsApp groups.

Central benefits (Main Themes)	Subthemes	Exemplary statements
Cognitive: Enhancing practical knowledge ($n = 85$)	Learning in general	*"I gained a lot. It also made me learn even though I wasn't reading textbooks*
	Acquiring new clinical knowledge	*"I also learned that episiotomy should be the last resort"*
	Reviewing relevant clinical knowledge from school	*"refreshing myself of various topics that I was taught in school"*
Social: Enacting connectedness and belonging ($n = 23$)	Interacting with peers	"*interact well with my colleagues and friends"*
	Constructing connectedness and belonging	*"I felt been connected with others after graduation"*
Professional: Obtaining informational benefits (n = 19)	Obtaining information about the profession	*"explore on new trends in nursing"*
	Being supported in professional immersion	*"How to prepare for job interview"*
Others: Leadership capacity and motivation (n = 11)	Expanding leadership capacity	*"I was motivated to lead others and to be a good follower."*
	Developing motivation to learn	*"Eagerness to learn and share thoughts with others"*

Table 3
Comparison between control and intervention cohort.

	Total			Control				Intervention							
	N	M	SD	n	M	SD	Mdn	n	M	SD	Mdn	t	p	*g*	95% CI *g* [LL, UL]
Knowledge score	216	6.67	2.161	87	5.72	1.696	5	129	7.31	2.211	7	−5.954	0.000***	−0.782	[−1.065, −0.500]
Knowledge transfer	173	4.95	0.768	66	4.93	0.715	5	107	4.96	0.803	5	−0.243	0.809	−0.037	[−0.344, 0.271]
Professional isolation	174	2.21	0.903	67	2.47	1.033	2	107	2.05	0.773	2	2.861	0.005**	0.474	[0.164, 0.784]
Resilience	174	5.00	0.482	67	4.89	0.509	5	107	5.06	0.436	5.1	−2.355	0.020*	−0.378	[−0.687, −0.070]
Stress job search	222	4.42	1.525	89	4.70	1.393	5	133	4.23	1.585	5	2.298	0.023*	0.306	[0.035, 0.576]
Stress job begin	174	3.95	1.436	67	4.03	1.487	5	107	3.9	1.407	4	0.585	0.560	0.092	[−0.214,0.398]

A significant *p*-value indicates that the corresponding Welch's t-test was significant. *g* represents Hedges' measure of effect size. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. Differences in the number of observations are due to missing values in the questionnaire. *Indicates $p < .05$. **Indicates $p < .01$. ***Indicates $p < .001$.

3.3.2. Social: enhancing connectedness and belonging

In a considerable number of comments ($n = 23$), the benefits of the WhatsApp group in maintaining and developing interpersonal relationships were highlighted. Some referred explicitly to the process of interacting, others emphasised the positive outcomes of this engagement, i.e. the achievement of a sense of connectedness and belonging to a social community: "*First and foremost, I gained a sense of love and belonging as a family*". Some emphasised the role and relevance of being re-connected with peers, and as the following statement shows, highlighted the value of these bonds for tackling the challenging immersion in practice: "*connecting with people who matter, without whom the journey to success would have been more tedious*".

3.3.3. Professional: obtaining informational benefits

In their statements ($n = 19$), the research participants also related to the benefit of obtaining professional information, which helped them immerse themselves in the new professional world and grapple with challenges that they encountered. The subtheme of learning about professional topics was often highlighted in connection with a particular topic of the curriculum, i.e., "New Nursing Technologies and Trends". This topic included, for example, electronic health records, point-of-care technology and patient and staff identification systems and was highly regarded. The second subtheme focused on the ways in which group participation helped the young professionals to become immersed in the world of work. This theme included moderators and nurses who posted links to job opportunities or who shared best practices for job interviews. In the process of obtaining informational professional benefits, the role of peers was highlighted: "*I learnt from my colleagues on the platform, while they shared their experiences from job interviews they've been through and that made me prepared for subsequent interviews I went for*".

3.3.4. Other themes: expanding leadership capacity and curiosity to learn

Finally, two minor yet interesting themes emerged from the analysis ($n = 11$). The participants who were selected by their peers to alternate as co-moderators pointed to an increase in their leadership skills, which, for example, some described as being motivating and leading to the development of "a sense of responsibility". In addition, some participants reported increased levels of motivation and interest in continued learning and professional development, e.g. "*a desire to learn more*" as a result of participating in the intervention.

3.4. Relationship: participation in WhatsApp groups and outcome indicators (RQ3)

In the next step, we measured whether the frequency of different participation modalities (reading vs writing) would predict the educational parameters of participants in the WhatsApp groups. The underlying assumption was that a higher frequency of reading and writing contributions would be associated with more positive outcomes. In the analysis, three measures of participation were used (Table 5). The actual use was determined by counting the number of contributions that each participant made in the WhatsApp group during the intervention, as specified in the methods section. The average number of the actual written contributions was M = 202, which however varied considerably, ranging from 1901 messages to making no written contribution at all. The self-reported WhatsApp use was differentiated according to the extent to which a participant engaged actively and passively, i.e. writing and reading messages in the WhatsApp groups (see methods section). As expected, the participants' self-reported measure of reading was higher than that of writing.

Table 5
Actual and reported participation in the moderated WhatsApp group.

WhatsApp group use	N	M	SD	Mdn	Min	Max
WA reading (reported)	133	5.27	0.95	5	1	6
WA writing (reported)	133	4.17	1.37	4	1	6
WA writing (actual)[a]	99	202	308	90	1	1901

[a]Actual number of messages posted in the moderated WhatsApp groups.

In the next step we examined the correlations. To link the actual with the reported participation in the moderated WhatsApp groups we matched the phone number that the participants provided in the survey with the number from the WhatsApp chat protocols. In this process, we requested explicit consent from the participants and 99 persons provided us with the permission to do so.

The first finding is that there were strong and statistically significant correlations between the three measures of participation in the WhatsApp group (Table 6). Participants who indicated having written many messages contributed indeed frequently to the WhatsApp groups, and the other way round. This result validates self-reported communication measures and is an interesting finding in itself. Similarly, there was also a positive though somewhat weaker association between writing and reading in the WhatsApp groups.

The correlation table (Table 6) reveals no connection of the participation in the moderated WhatsApp group and the outcome measures. Neither the frequency of writing nor the frequency of reading WhatsApp contributions was linked to the indicators that were significantly more positive in the intervention group compared to the control group (i.e. knowledge score, professional isolation, and stress in the job search phase, see Table 3). However, there was a significant correlation observed between the general, day-to-day use of WhatsApp (outside of the moderated WhatsApp groups of the intervention) and resilience. In addition, resilience was negatively linked to stress at the beginning of a new job; and both stress levels during the search of a new job and at the beginning of a new job also correlated highly.

The missing link between WhatsApp participation and outcome indicators was further corroborated by four regression models (Table 7 to 10) that we used to test whether the frequency of different forms of WhatsApp usage would predict these outcome variables, using general WhatsApp use, age and months working as control variables. Because only complete data from participants in the intervention group could be included in this analysis, the sample size was reduced to $n = 78$. All linear models satisfied the assumptions of linearity, homogeneity of variance, normality of residuals, except the model with professional isolation and the model with stress in the phase of job search as the dependent variable. For both models, the assumption of normality of the residuals was violated. However, all results were cross-checked using robust MM-type estimators for linear regression as implemented in the package "robustbase" by Maechler, Rousseeuw, Croux, Todorov, et al. (2020) (see Appendix C).

The results of multiple linear regression analysis show that neither the frequency of writing contributions in the Whatsapp intervention group (the actual participation) nor the self-reported reading on WhatsApp were significant predictors for resilience, knowledge score, or professional isolation. However, the general use of WhatsApp, i.e. the day-to-day use of WhatsApp outside of the intervention, predicted resilience. In other words, professionals who reported a higher general, day-to-day use of WhatsApp had higher levels of resilience. Moreover, resilience was also predicted by age in that older participants reported higher levels of resilience in this model.

The regression models for knowledge score, professional isolation, and stress in the phase of searching for a job explained only little variance in the dependent variable (R^2 between 0.009 and 0.037). By contrast, the regression model including age, months working and the different measures of WhatsApp use explained about 20% of the variance of resilience ($R^2 = 0.196$).

In the sense of an additional, exploratory analysis we further investigated the interesting correlation between the general, day-to-day use of WhatsApp and resilience. We did so by using multiple linear regression analysis, controlling for age and months working (Table 11). The calculation drew on the data from both the intervention and control group (other than the previous regressions which refered to the

Table 6
Correlations (Kendall's tau) in the intervention group.

	1	2	3	4	5	6	7	8	9	10
WhatsApp use										
1) WA Writing (actual, log)	1									
2) WA Writing (reported)	0.56***	1								
3) WA Reading (reported)	0.24**	0.21*	1							
4) GWA averaged (reported)[a]	0.32**	0.37**	0.35**	1						
Educational indicators										
5) Knowledge score	0.07	0.05	0.03	−0.01	1					
6) Knowledge transfer	0.10	0.04	0.11	0.07	0.00	1				
7) Professional isolation	−0.01	−0.06	−0.07	0.02	−0.08	−0.04	1			
8) Resilience	0.12	0.16	0.12	0.21**	−0.10	0.06	−0.10	1		
9) Stress job search	−0.05	−0.01	−0.05	0.08	0.06	−0.01	0.13	−0.06	1	
10) Stress job begin	−0.04	−0.07	0.03	0.05	−0.06	0.06	0.11	−0.24**	0.42**	1

*Indicates $p < .05$. **Indicates $p < .01$. ***Indicates $p < .001$.
[a] General WhatsApp use (averaged measure of reported reading and writing).

Table 7
Regression results using **resilience** as the criterion.

Predictor	*b*	*b* 95% CI [LL, UL]	*beta*	*beta* 95% CI [LL, UL]	sr^2	sr^2 5% CI [LL, UL]	*r*	Fit
(Intercept)	3.02**	[1.95, 4.10]						
Age	0.05**	[0.01, 0.08]	0.33	[0.10, 0.55]	0.09	[−0.02, 0.21]	0.26*	
Months working	0.02	[−0.03, 0.07]	0.08	[−0.14, 0.30]	0.01	[−0.03, 0.04]	0.16	
WA writing (actual,log)	0.03	[−0.04, 0.09]	0.10	[−0.15, 0.34]	0.01	[−0.03, 0.04]	0.15	
WA reading (reported)	0.07	[−0.06, 0.20]	0.14	[−0.12, 0.40]	0.01	[−0.03, 0.06]	0.18	
GWA averaged (reported)	0.08	[−0.03, 0.20]	0.19	[−0.08, 0.46]	0.02	[−0.04, 0.08]	0.30**	
								$R^2 = 0.196$**
								95% CI[0.02,0.31]
								$R^2_{Adjusted} = 0.140$

Number of observations = 78. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *Beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. *Indicates $p < .05$. **Indicates $p < .01$.

Table 8
Regression results using **knowledge score** as the criterion.

Predictor	*b*	*b* 95% CI [LL, UL]	*beta*	*beta* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	7.64*	[1.78, 13.49]						
Age	−0.05	[−0.23, 0.13]	−0.07	[−0.32, 0.18]	0.00	[−0.02, 0.03]	−0.11	
Months working	0.00	[−0.26, 0.26]	0.00	[−0.24, 0.25]	0.00	[−0.00, 0.00]	0.00	
WA writing (actual,log)	0.19	[−0.18, 0.55]	0.14	[−0.13, 0.41]	0.01	[−0.04, 0.06]	0.15	
WA reading (reported)	0.08	[−0.64, 0.79]	0.03	[−0.25, 0.32]	0.00	[−0.01, 0.01]	0.07	
GWA averaged (reported)	−0.11	[−0.75, 0.53]	−0.05	[−0.35, 0.25]	0.00	[−0.02, 0.02]	0.04	
								$R^2 = 0.029$
								95% CI[0.00,0.06]
								$R^2_{Adjusted} = -0.039$

Number of observations = 78. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *Beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. *ndicates $p < .05$.

Table 9
Regression results using **professional isolation** as the criterion.

Predictor	*b*	*b* 95% CI [LL, UL]	*beta*	*beta* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	2.76*	[0.67, 4.84]						
Age	−0.02	[−0.09, 0.04]	−0.09	[−0.34, 0.16]	0.01	[−0.03, 0.05]	−0.08	
Months working	0.00	[−0.09, 0.09]	0.00	[−0.24, 0.25]	0.00	[−0.00, 0.00]	0.00	
WA writing (actual,log)	0.00	[−0.13, 0.13]	0.00	[−0.28, 0.28]	0.00	[−0.00, 0.00]	0.02	
WA reading (reported)	−0.04	[−0.30, 0.21]	−0.05	[−0.34, 0.24]	0.00	[−0.02, 0.02]	−0.01	
GWA averaged (reported)	0.03	[−0.20, 0.25]	0.03	[−0.26, 0.33]	0.00	[−0.01, 0.01]	0.02	
								$R^2 = 0.009$
								95% CI[0.00,1.00]
								$R^2_{Adjusted} = -0.060$

Number of observations = 78. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *Beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. *Indicates $p < .05$.

Table 10
Regression results using **stress during job search** as the criterion.

Predictor	*b*	*b* 95% CI [LL, UL]	*beta*	*beta* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	1.72	[−1.89, 5.32]						
Age	0.05	[−0.06, 0.16]	0.11	[−0.13, 0.36]	0.01	[−0.03, 0.06]	0.09	
Months working	0.02	[−0.14, 0.18]	0.02	[−0.22, 0.27]	0.00	[−0.01, 0.01]	0.00	
WA writing (actual,log)	−0.05	[−0.28, 0.17]	−0.06	[−0.33, 0.21]	0.00	[−0.02, 0.03]	−0.05	
WA reading (reported)	0.32	[−0.12, 0.76]	0.21	[−0.08, 0.49]	0.03	[−0.04, 0.10]	0.11	
GWA averaged (reported)	−0.11	[−0.51, 0.28]	−0.09	[−0.38, 0.21]	0.00	[−0.02, 0.03]	−0.01	
								$R^2 = 0.037$ 95% CI[0.00,0.08] $R^2_{\text{Adjusted}} = -0.030$

Number of observations = 78. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *Beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.

Table 11
Regression results: **resilience** as criterion (General WhatsApp use as predictor).

Predictor	*b*	*b* 95% CI [LL, UL]	*beta*	*beta* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	3.54**	[2.89, 4.19]						
Age	0.03**	[0.01, 0.06]	0.22	[0.07, 0.36]	0.05	[−0.01, 0.10]	0.18*	
Months working	0.01	[−0.03, 0.04]	0.02	[−0.12, 0.17]	0.00	[−0.01, 0.01]	0.04	
GWA averaged (reported)	0.14**	[0.07, 0.21]	0.31	[0.16, 0.45]	0.09	[0.01, 0.17]	0.28**	
								$R^2 = 0.127$** 95% CI[0.04,0.21] $R^2_{\text{Adjusted}} = 0.112$

Number of observations = 172. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *Beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. *Indicates $p < .05$. **Indicates $p < .01$.

participation in the moderated groups and were thus only applicable for the intervention group). The analysis shows that general WhatsApp use, i.e. the use of WhatsApp outside of the intervention, predicted resilience. This means that participants who generally use WhatsApp more frequently (outside of the intervention) also had higher levels of resilience, and vice versa. The model satisfied the assumptions of linearity and homogeneity of variance, but the assumption of normality of the residuals was violated. However, results of the robust model using robust MM-type estimators for linear regression yielded very similar results (Maechler et al., 2020) (see Appendix C).

4. Discussion

The main results of the present study are that, in comparison with the control group, participants in the WhatsApp groups had pronouncedly ($r = 0.36$) higher levels of knowledge and moderately ($r = 0.15$–0.18), but significantly greater resilience and lower levels of professional isolation and of stress in the phase of searching for a job (RQ1). The qualitative analysis of the open survey questions affirmed the central value of moderated instant messaging groups regarding knowledge acquisition and connectedness (RQ2). The frequency of writing and reading contributions in the WhatsApp intervention did not predict outcome indicators (RQ3). A further interesting finding is that the general, day-to-day use of WhatsApp outside of the intervention was linked to higher levels of resilience. These findings corroborate, extend and partly question extant literature, as we will discuss in the following sections.

4.1. Contextualisation of findings in the literature

Firstly, this study adds another layer of evidence to the thin but emerging corpus of educational studies that connects the systematic use of MIM with cognitive and knowledge outcomes using experimental approaches (Tang & Hew, 2017). In particular, it corroborated the study of Pimmer et al. (2019), which observed knowledge gains in a similar context in which new graduates were supported with moderated WhatsApp groups. The present research design did not permit the determination of specific influencing factors within the intervention design that explain these knowledge gains in comparison to previous studies that found no or partly negative effects (Kim et al., 2014; Lai, 2016). However, the examination of the context and nature of the intervention can offer some explanations why the acquisition of knowledge was successful. Firstly, learners did not acquire entirely new knowledge, as the content represented mostly repetition that drew on an already established corpus of knowledge from the school setting. Secondly, unlike school-centred education, which prepares learners for the potential application of knowledge in the future, the content discussed in the WhatsApp groups met immediate and situated needs and demands of learners already immersed in the world of work, leveraging the instant nature of MIM-based communication. Thirdly, the way in which knowledge was conveyed incorporated principles of gamification in that the quizzes at the end of each week added a friendly and voluntary but still competitive element (Kiryakova et al., 2014). This feature has likely helped the group in navigating dialectical tensions between task and ludic orientation, which are emblematic for the implementation of a private social media app in formal education settings (Pimmer & Rambe, 2018).

Whereas the participants in the WhatsApp groups had a higher knowledge score and many described the main benefit of participating to be the learning and knowledge gains, the level of (self-reported) knowledge transfer from education to practice did not differ significantly from the control group. This is in contrast to other qualitative studies that emphasised the potential of WhatsApp groups to foster the application of knowledge and theory from school to practice learning settings (Willemse, 2015; Willemse & Bozalek, 2015). The finding is also contrary to our intention of supporting graduates in the application of school knowledge in their new jobs. A simple interpretation might be that the participants did not connect the intervention and the knowledge that was shared in the groups to their school contexts, as the intervention was carried out and moderated by practitioners from outside of the participants' prior education environments.

The second main finding is that the interactions in the groups were

linked to the socio-cultural indicator of reduced professional isolation, which can be viewed as a central construct from a learning-as-participation metaphor (Sfard, 1998). In other words, maintaining established social capital by interacting with former student peers (Ellison et al., 2007) and connecting new graduates with experienced professionals who acted as moderators, were linked to an enhanced sense of professional connection. This finding does not only corroborate previous studies that highlighted the affordances of instant messaging as an enabler of social presence, connectedness and togetherness in formal and informal settings (e.g. Karapanos et al., 2016; Kim et al., 2014; O'Hara et al., 2014) including the field of healthcare providers (Henry et al., 2015). It also makes the present work one of the first studies to show that a digital, MIM-based transition support programme can actively support sociocultural participation and professional integration.

Another relevant finding is that the connections that graduates enact with former student peers and moderators in an instant messaging space are linked to heightened resilience. In other words, the WhatsApp groups can be conceived as a resource on which graduates could draw on in more stressful situations, strengthening their ability to tackle problems and obstacles in periods marked by uncertainty and change (Campbell-Sills & Stein, 2007). Resilience is often used in social sciences and education studies and has particular relevance in transition phases (Wahab et al., 2017; Wangensteen et al., 2008). The impact of social media use on resilience has been conceptualised with respect to the Covid-19 crises (Mano, 2020). However, this relationship has been rarely applied in the study of educational technology. One prior study suggests that the informal use of social media and instant messaging correlated with enhanced levels of resilience in placement learning settings. The social media measurement included but did not differentiate instant messaging (Sigalit et al., 2017). The present findings add to the literature in that they support the conclusion that the general, day-to-day use of WhatsApp is connected to enhanced levels of resilience. In addition, they also show that resilience can be deliberately and systematically strengthened through interventions in moderated MIM groups.

Another difference between the intervention and control condition is the lower level of stress reported by participants in the WhatsApp groups, whilst seeking a new job. The finding that lower stress levels in the intervention group did not continue to manifest in the phase when the graduates started their job can be a consequence of the many other influences that impact stress in this new context, such as workload, leadership style and conflicts (McVicar, 2003), which may have diluted the effect of the MIM-based transition support.

A notable "by-product" of this research is the finding that the actual and self-reported participation, i.e. writing messages in the WhatsApp groups, correlated highly. The comparison of actual and self-reported use is an interesting approach in itself, as most of the recent literature on social media (e.g. Al-Rahmi, Alias, Othman, Marin, & Tur, 2018; Vareberg, Luo, Westerman, Bartels, & Lindmark, 2020), including some of the classics (e.g. Ellison et al., 2007), rely on self-reported measurements which are, however, contested (Araujo, Wonneberger, Neijens, & de Vreese, 2017; Junco, 2013). The present findings corroborate more recent work saying that self-reported behaviour on social media can provide some meaningful insights into the actual behaviour (Mosleh, Pennycook, & Rand, 2020).

However, more important for this study was the question whether actual and/or self-reported behaviour can be linked to any of the outcome indicators (RQ3), which was not the case. In detail, the modality of participation as expressed through the frequency of writing and reading did not predict any of the cognitive, sociocultural and socio-professional outcome indicators. These findings cast doubt on the external validity of prior MIM studies that found correlations between frequency and educational outcomes in MIM (Lai, 2016; Pimmer et al., 2019), suggesting that frequency and time of engagement is a questionable proxy for cognitive and sociocultural outcomes, at least in social media spaces. One interpretation is that, in ephemeral social media and MIM spaces in which intellective engagement is blurred by lightweight conversations, multitasking and distractions (Aburezeq & Ishtaiwa, 2013; Bouhnik & Deshen, 2014; Bowman, Levine, Waite, & Gendron, 2010; Kim et al., 2014) time measures do not reflect the outcomes in a way that "more" necessarily means "better". Measures that capture the quality and depth of reasoning instead of simple time and frequency measures are possibly more predictive of cognitive and sociocultural results of social media engagement, but more research is clearly needed.

4.2. Practical implications

This project did not only show the feasibility of the use of instant messaging in the school-to-job transition but the research outcomes also confirm its practical value with attention to the particular context of transitioning. In essence, WhatsApp support was linked to (1) learning and knowledge gains in a phase in which many graduates experience a lack of knowledge and competencies (Casey et al., 2004; Fink et al., 2008); (2) higher levels of professional connectedness in a setting marked by isolation and low levels of professional integration and belonging (Fink et al., 2008; McKenna & Newton, 2008); and (3) higher resilience in a highly stressful and demanding phase in which professionals' main route of learning and development lies in their ability to positively adapt to challenging situations (Wahab et al., 2017; Wangensteen et al., 2008).

Moreover, the voluntarily engagement of the participants for six months, for which they did not receive financial compensation, underpins their intrinsic motivation and shows the value that they attached to this kind of support structure in itself. This hints at the general, broad applicability of the approach also beyond the field of health professional education. In the light of the approach's scalability, an enabling factor is certainly the use of instant messaging, i.e. of technologies which are already in the hands of many health professionals in low and middle income countries (and beyond) who are increasingly adopting MIM for professional and educational purposes (Hampshire et al., 2016; Henry et al., 2015; Pimmer, Lee, & Mwaikambo, 2018). Yet, in scaling up the study's approach, the time and effort needed for the facilitation and moderation of the digital spaces have to be taken into account. The immediacy and 24/7 characteristics inherent in the nature of instant messaging need to be reflected in the moderation, which can be a demanding task at times, as other studies have also shown (Bouhnik & Deshen, 2014). In this light, the present study documented that some parts of the moderation can be handed over to new graduates who take on the role of co-moderators. This kind of "added" co-moderation is similar to the one that Cassaniti, Mwaikambo, and Shore (2014) employed in their study on the use of Facebook groups by Nigerian laboratory assistants. This line of argumentation is further underpinned by the indications in the qualitative part of the present study that suggest that this measure increased the sense of responsibility and (digital) leadership skills of the co-moderators. Nevertheless, further research and practice are necessary to gain a better understanding of the role of graduates' co-moderation and the associated dynamics and outcomes.

4.3. Strengths, limitations and future research

The strengths of the current study can be seen in its rich measurement approaches and its triangulation, for example in the way in which potential benefits of the participation in the WhatsApp groups were measured using psychometric constructs, knowledge tests, and self-reported, open responses gathered via the open survey questions. Similarly, the study also measured and compared self-reported and actual participation patterns, which only a few studies do (Junco, 2013). However, the study's findings need to be understood and interpreted in the light of limitations arising from its design and context.

One limitation is that the type of knowledge circulated and tested in

the quizzes focused on retention and can be conceived as rote learning. Although knowledge about clinical rules and guidelines is, without question, very relevant in the daily work of newly graduated health professionals, the tests did not capture higher-order learning processes and associated results such as deep, critical and creative learning and reflection, sense making, and the co-construction and re-contextualisation of knowledge (Mayer, 2002; Turvey, 2006). In this way, the study confirms but does not extend the extant mobile learning literature in higher education settings that focus on relatively straightforward approaches of knowledge acquisition and retention (Pimmer, Mateescu, & Gröhbiel, 2016). Future research might thus measure higher-order learning processes and outcomes, for example by analysing the co-construction of knowledge, or the level of reflective practice, using methods of content analysis, such as in the study of Kim et al. (2014); or test the extent to which knowledge can be applied in new tasks and situations.

Another methodological limitation is that the triangulation drew on a qualitative analysis of the responses to the open survey questions. Although the insights gained from this data source supported and enriched the overall findings, they did not involve the collection and analysis of more in-depth accounts which could be gained from focus groups or individual interviews and which might have led to a more nuanced understanding of the use of the instant messaging platform.

In addition, the comparison of actual and self-reported measures was only possible for the concept of writing contributions, as this could be measured in a straightforward way. It did, however, not include the measurement of the extent to which participants actually read contributions or the overall time spent on the platform, which would have required the implementation of a much more sophisticated user tracking software (Junco, 2013). Importantly, this research has shown the need for future research that explores engagement and participation measures that can better predict educational outcomes for social media, and MIM use in particular.

A further crucial limitation is that participant allocation was performed on a school level and not on an individual level. The use of pre-existing clusters, i.e. intact social units, was a deliberate step to enable new graduates in leveraging their pre-existing social capital with former classmates (Ellison et al., 2007). However, the fact that effects were measured on individual and not on school levels restricts the robustness of the study design. It is thus desirable for future studies to involve considerably more schools and to carry out the analysis at the level of clusters in addition to the analysis at the level of individuals.

A final limitation is that the study compared the WhatsApp-based intervention with a control group that was not subjected to any activity. This made sense in the low-resource context under investigation in which the technological choice was very limited. In other words, although the results point to the positive effects of WhatsApp engagement compared with no support, it is not clear whether the use of other digital apps might have possibly resulted in even better outcomes.

5. Conclusion

The study's rationale was to contribute to the thin but emerging body of literature on the use of mobile instant messaging in learning and teaching settings, and, moreover, to the even thinner corpus of studies that examine the use of digital technologies in study-to-job transition programmes, which is a relevant but under-researched field of educational technology studies.

The key findings are that the engagement of new graduates in moderated WhatsApp groups was connected to markedly enhanced levels of knowledge, and slightly but still significantly greater resilience, lower levels of professional isolation, and less stress in the job search phase - compared with the control condition. These results, which are affirmed by the qualitative analysis of the open survey questions, extend previous literature suggesting that instant messaging can support relatively simple but relevant forms of knowledge acquisition and retention. Moreover, the study corroborates previous work which points to the potential of MIM use to establish a social presence, as it showed that the engagement with former student peers and experienced professionals (the moderators), helped reduce feelings of professional isolation. In addition, the participation in the WhatsApp groups also resulted in higher levels of resilience, which is of particular relevance in the challenging contexts under investigation. A further interesting finding is that also the general, day-to-day use of WhatsApp outside of the intervention was linked to higher levels of resilience.

The intervention also demonstrates the practical value of leveraging mobile applications that are already in the hand of many users in resource-poor settings, where transitional challenges can be even more pronounced because there are limited other technical and structural support mechanisms in place. Finally, the study's finding that the frequency of writing and reading contributions in the WhatsApp groups did not predict any of the educational outcome indicators is suggestive of the need for measurements that capture the depth and quality of engagement in social media spaces rather than its quantity.

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Appendix A. Measures and questions

The following constructs were measured using a six-point Likert scale with the items "strongly disagree", "disagree", "somewhat disagree", "somewhat agree", "agree", strongly agree".

A.1. Knowledge transfer

- I frequently apply knowledge gained from my School/Department of Nursing in my current job.
- It is easy to transfer knowledge gained from my School/Department of Nursing in my current job
- The knowledge gained from my School/Department of Nursing helps me to perform well in my work in my current position
- The knowledge gained at my School/Department of Nursing is relevant to tackling daily work tasks in my current job.

A.2. Professional isolation

- I feel disconnected with other nurses.

- I have no sense of togetherness with other nurses.
- I don't feel related well with other nurses.
- I feel so distant from other nurses.

A.3. Resilience

- I'm able to adapt to change
- I can deal with whatever comes
- I try to see the positive side of problems
- Coping with stress can strengthen me
- I tend to bounce back after illness or hardship
- I can achieve goals despite obstacles
- I can stay focused under pressure
- I'm not easily discouraged by failure
- I consider myself as a strong person
- I can handle unpleasant feelings

A.4. Stress job search

- Searching for a job after my graduation from the Nursing School/Department has been very stressful.

A.5. Stress job begin

- Beginning a job after my graduation from the Nursing School/Department has been very stressful.

A.6. Self-reported participation in the moderated WhatsApp groups

- I have written many messages in the moderated WhatsApp group.
- I have frequently read messages of others in the moderated WhatsApp group

A.7. General WhatsApp use (outside of the intervention)

- In general, I write many messages on WhatsApp
- In general, I frequently read messages of others on WhatsApp.

Appendix B. Results of the Wilcoxon signed-rank tests

Table 12: Robust Wilcoxon signed-rank tests.

	W	p	r	95% CI r [LL, UL]
Age	6484.5	0.949	0.004	[0.002, 0.14]
Months working	4564.5	0.265	0.081	[0.0063, 0.21]
GWA reading (reported)[a]	6425.5	0.256	0.076	[0.0029, 0.21]
GWA writing (reported)[a]	5576.5	0.433	0.053	[0.0032, 0.18]
GWA averaged (reported)[a]	6057	0.764	0.020	[0.002, 0.16]
Knowledge score	1882.5	0.000***	0.396	[0.27, 0.52]
Knowledge transfer	3394.5	0.744	0.025	[0.0024, 0.17]
Professional isolation	4344.5	0.0166*	0.182	[0.03, 0.32]
Resilience	2909.5	0.0364*	0.159	[0.02, 0.31]
Stress job search	6921	0.0271*	0.148	[0.02, 0.27]
Stress job begin	3853	0.392	0.065	[0.0048, 0.21]

r indicates standardized effect size. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. *Indicates $p < .05$. ***Indicates $p < .001$.

[a] General WhatsApp use: reading, writing and averaged.

Appendix C. Appendix C: Results of the robust multiple linear regressions

Table 13: Robust regression results using **resilience** as the criterion

Predictor	b	SE	95% CI		p	Fit
			LL	UL		
Intercept	2.834	0.569	1.719	3.949	0.000**	
Age	0.048	0.016	0.016	0.08	0.004**	
Months working	0.026	0.024	−0.022	0.073	0.295	
WA writing (actual,log)	0.021	0.029	−0.036	0.078	0.474	
WA reading (reported)	0.078	0.067	−0.053	0.209	0.248	
GWA averaged (reported)	0.108	0.077	−0.042	0.259	0.162	
						$R^2 = 0.225$
						$R^2_{Adjusted} = 0.171$

Number of observations = 78. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. *Indicates $p < .05$. **Indicates $p < .01$.

Table 14: Robust regression results using **knowledge score** as the criterion

Predictor	b	SE	95% CI		p	Fit
			LL	UL		
Intercept	8.042	2.876	2.405	13.678	0.007**	
Age	−0.068	0.094	−0.252	0.115	0.466	
Months working	0.021	0.127	−0.228	0.27	0.871	
WA writing (actual,log)	0.147	0.188	−0.223	0.516	0.439	
WA reading (reported)	0.109	0.285	−0.45	0.668	0.703	
GWA averaged (reported)	−0.114	0.305	−0.711	0.483	0.709	
						$R^2 = 0.030$
						$R^2_{Adjusted} = -0.037$

Number of observations = 78. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. ** Indicates $p < .01$.

Table 15: Robust regression results using **professional isolation** as the criterion

Predictor	b	SE	95% CI		p	Fit
			LL	UL		
Intercept	2.665	0.823	1.052	4.278	0.002**	
Age	−0.02	0.02	−0.058	0.019	0.314	
Months working	−0.016	0.034	−0.083	0.051	0.634	
WA writing (actual,log)	−0.027	0.045	−0.116	0.061	0.55	
WA reading (reported)	−0.023	0.117	−0.253	0.207	0.845	
GWA averaged (reported)	0.025	0.079	−0.13	0.181	0.749	
						$R^2 = 0.013$
						$R^2_{Adjusted} = -0.055$

Number of observations = 78. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.

Table 16: Robust regression results using stress during job search as the criterion

Predictor	b	SE	95% CI		p	Fit
			LL	UL		
Intercept	1.631	1.52	−1.348	4.61	0.287	
Age	0.048	0.047	−0.045	0.141	0.311	
Months working	0.007	0.096	−0.18	0.194	0.94	
WA writing (actual,log)	−0.057	0.101	−0.255	0.142	0.576	
WA reading (reported)	0.356	0.201	−0.038	0.749	0.08	
GWA averaged (reported)	−0.095	0.179	−0.446	0.256	0.596	
						$R^2 = 0.042$
						$R^2_{Adjusted} = -0.025$

Number of observations = 78. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.

Table 17: Robust Regression: Resilience as criterion and general WhatsApp use as predictor

	b	SE	95% CI		p	Fit
			LL	UL		
(Intercept)	3.438	0.33	2.791	4.085	<2e-16 ***	
Age	0.037	0.012	0.013	0.06	0.003***	
Months_working	0.008	0.016	−0.023	0.038	0.611	
GWA averaged (reported)	0.15	0.033	0.085	0.216	1.29e-05 ***	
						$R^2 = 0.160$
						$R^2_{Adjusted} = 0.145$

***Indicates $p < .001$.

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