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Using a Smartphone App and Coaching Group Sessions to Promote Residents' Reflection in the Workplace

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Abstract

Problem

Reflecting on workplace-based experiences is necessary for professional development. However, residents need support to raise their awareness of valuable moments for learning and to thoughtfully analyze those learning moments afterwards.

Approach

From October to December 2012, the authors held a multidisciplinary six-week postgraduate training module focused on general competencies. Residents were randomly assigned to one of four conditions with varying degrees of reflection support; they were offered (1) a smartphone app, (2) coaching

group sessions, (3) a combination of both, or (4) neither type of support. The app allowed participants to capture in real time learning moments as a text note, audio recording, picture, or video. Coaching sessions held every two weeks aimed to deepen participants' reflection on captured learning moments. Questionnaire responses and reflection data were compared between conditions to assess the effects of the app and coaching sessions on intensity and frequency of reflection.

Outcomes

Sixty-four residents participated. App users reflected more often, captured more learning moments, and reported

greater learning progress than nonapp users. Participants who attended coaching sessions were more alert to learning moments and pursued more follow-up learning activities to improve on the general competencies. Those who received both types of support were most alert to these learning moments.

Next Steps

A simple mobile app for capturing learning moments shows promise as a tool to support workplace-based learning, especially when combined with coaching sessions. Future research should evaluate these tools on a broader scale and in conjunction with residents' and students' personal digital portfolios.

Problem

Reflecting on one's experiences in the workplace is essential for the professional development of physicians,¹ particularly of residents who are still in training, for it supports moral, personal, psychological, emotional, and cognitive growth and lifelong learning.² Reflection has been defined as "a systematic and critical analysis of past actions and their consequences"³ which guides one's future behavior and is one of the main processes by which individuals learn in the workplace.¹ However, it does not happen intuitively or spontaneously^{3,4}; the active promotion of reflection is therefore necessary.

Nevertheless, reflection is often underused as an educational tool,² and we lack knowledge on how to best scaffold it.¹

Many opportunities for reflection in clinical settings are lost because of a lack of time² or the absence of reflection in training programs.⁵ In addition, continuous self-monitoring, or the ability to attend to one's actions as well as to their effects, is needed for reflection.⁶ This mindful attention to one's thoughts and emotions can be achieved by self-recording,⁷ which often takes the form of brief paper-and-pencil notes, critical incident reports, or portfolios. A delay between the event triggering the reflection and its recording might contribute to one's thoughts being forgotten or inaccurately recorded, as the "immediate recording of thoughts is likely to be a closer reflection of underlying beliefs."⁷ New technologies, which use multiple media instead of only written words, offer opportunities to promote real-time reflection and to capture potential instructive moments (referred to here as learning moments) in the workplace for later in-depth reflection.

Yet, reflection without further guidance, dialogue, or discussion has limited effects on learning.^{5,7,8} Group meetings among peers encourage reflection and the exploration of situations from different perspectives, and they deepen understanding of experiences and stimulate professional development.⁴ A coach can facilitate this process through counseling and mentoring⁷ and by providing feedback.⁸ Guidance and support are indispensable to the reflection process and to professional development.^{4,5}

We therefore expect that we can promote residents' reflection in the workplace by offering them both a smartphone app to capture learning moments in real time as text notes, audio recordings, pictures, or videos, and coaching sessions in the form of supervised group discussions during which such learning moments and workplace experiences can be analyzed thoroughly.

Approach

We developed a six-week postgraduate training module for residents, which ran from October to December 2012.

Please see the end of this article for information about the authors.

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Participants were recruited from multiple specialties at several hospitals in the Netherlands. We invited all residents from Academic Hospital Maastricht (about 300) by e-mail and some residents from Atrium Hospital Heerlen (about 20) during an in-person meeting. Some participants took part in the project while doing their placements at other hospitals in the Netherlands. To encourage residents, who are required to earn one training certificate per year, to participate in the study, we awarded all participants a training certificate upon full completion of the project. Interested residents volunteered to participate.

Using stratified randomization (for year of training and type of specialty), we assigned each participant to one of four conditions: They were offered (1) a smartphone app, (2) coaching sessions, (3) a combination of both, or (4) neither type of support. Two participants were expats at the time of the study and were therefore assigned to the noncoaching conditions.

Reflection app

A smartphone app was developed for the quick and easy capture of learning moments in the workplace (see Supplemental Digital Appendix 1 at <http://links.lww.com/ACADMED/A313>). Users could choose the most appropriate medium for capturing a particular learning moment—text notes, pictures, audio recordings, and videos. Files were stored locally on the user's mobile phone and synchronized to an electronic learning environment. A three-day inactivity period triggered a text alert, reminding the user to continue capturing her or his learning moments. Participants were specifically instructed to consider the privacy of patients, to only register anonymized information, and to strictly follow the privacy guidelines of their hospital.

Participants in the nonapp conditions were instructed to capture their learning moments in the usual ways—for instance on paper, by memorization, or otherwise. A pairing system was put in place by which participants in the nonapp conditions received a reminder when matching participants in the app conditions received a text alert.

Coaching sessions

Participants in the coaching conditions were divided into groups of seven to

nine residents. These groups met three times at two-week intervals over a period of six weeks. These two-hour sessions were compulsory, interdisciplinary, and facilitated by a clinician who was an experienced coach and clinical supervisor. During the meetings, participants shared reflections they had captured since the previous meeting by presenting the case(s) to each other and discussing the experience, circumstances, people involved, and their own (and others') reactions and behaviors. Group members reflected on the case(s), presented relevant knowledge, asked questions, suggested alternative solutions, and shared their similar past experiences. In preparation for each meeting, participants sent the coach a description of their learning moments by e-mail. They were free to choose the format, as long as the content of the learning moment was clearly described.

Participants in the noncoaching conditions were required to use a three-column reflection form to elaborate on their learning moments. On this form, they detailed the learning moment, explained how they dealt with it, and evaluated the approach they chose. Each row on the form contained a separate learning moment. As in the coaching condition, the form had to be submitted once every two weeks.

Measures

We investigated whether use of the reflection app and participation in the coaching sessions increased intensity and frequency of reflection. We also tested whether these two types of support together fostered additional reflection. To measure intensity of reflection, we used the four-item reflection scale from the Level of Reflective Thinking Questionnaire,⁹ which inquires about the extent to which residents reflect on their practice. Participants completed this questionnaire at pretest and posttest ($\alpha_{\text{pretest}} = 0.75$; $\alpha_{\text{posttest}} = 0.74$). Participants also self-reported on their learning progress by completing a five-item questionnaire, which asked about the amount they had learned in the workplace, their alertness to learning moments, and the activities they had pursued to follow up on their learning moments. The latter two categories were subdivided into two separate items focusing on general competencies

(indicating alignment with the project's aim) and medical competencies (indicating that the reflection had an unintended focus). Participants completed this questionnaire at posttest only.

We objectively measured frequency of reflection by counting the number of (1) entries made in the app per working day, (2) cases submitted in advance of the coaching sessions, and (3) learning moments included on the reflection forms for those in the noncoaching conditions.

Procedure

We held an introductory meeting for all participants during which we explained the aims of the project and the format of the coaching sessions, provided instructions on app use, and had participants fill out the pretest, which included the reflection scale from the Level of Reflective Thinking Questionnaire.⁹ The six-week study period followed, during which participants used the app and/or attended the coaching sessions. As four participants in the app conditions did not possess a smartphone, we loaned each a device for the duration of the study period.

Participants were instructed to reflect specifically on learning moments related to general competencies, such as communication, collaboration, management, patient safety, ethics, and professionalism. We presented examples of such learning moments and anticipated that reflections on these competencies would be complex and multifaceted, and thus participants could not consult books to resolve them. A focus on general competencies also allowed us to organize interdisciplinary group sessions in which the problems encountered could be discussed from different perspectives. One week after completion of the project, participants filled out the posttest, which included both the items on the pretest and the five items on self-perceived learning in the workplace.

Analysis

To examine the effects of the various types of support, we compared data across the four conditions. We used repeated-measures analyses with the

factors “app” and “coaching” for the reflection scale. We conducted two-way ANCOVAs to test the effects of the app and coaching sessions on the increase in the amount of learning in the workplace that participants reported. We used one-way ANCOVAs to test the measures that applied to only two conditions. Covariates were the number of actual working days between pretest and posttest and years of experience in clinical practice. Because of the limited sample size, we also report trends with $P < .10$. We used partial eta-squared as a measure of effect size, with 0.01 corresponding to small effects, 0.06 to medium effects, and 0.14 to large effects. For all analyses, we used IBM SPSS Statistics for Mac, version 20.0 (Armonk, New York: IBM Corp.).

The Netherlands Association for Medical Education provided ethical approval before the study commenced (nr. NERB0031), and residents gave informed consent prior to participating.

Outcomes

Participants were 64 first- to fifth-year residents (mean age: 30 years old; 48.40% women). Coaching session attendance was high (97.84%; 2 of 31 participants missed one of three sessions), and almost all reflection forms were submitted (97.98%; 2 of 99 forms from 33 participants were not submitted). The pretest and posttest response rates were 100%. See Table 1 for the mean scores of the measures of intensity of reflection and frequency of reflection for each condition.

Regarding intensity of reflection, we found that for app users, reflection scale scores increased over time, while the reverse proved true for nonapp users ($P = .04$; see Table 2). Similarly, app users reported a larger increase in the amount they learned in the workplace than nonapp users ($P = .05$). No effects of coaching and no interaction effects were found. Coaching session attendance bolstered both participants' alertness to learning moments related to the general competencies as well as the number of corresponding follow-up learning activities (both $P = .01$). This also tended to be the case for alertness to learning moments related to the medical competencies, albeit without the corresponding increase in the number of corresponding follow-up activities.

App users tended to be more alert to learning moments related to the medical competencies and to pursue more corresponding follow-up activities, but the same was not true for their experience with learning moments related to the general competencies. We found an interaction effect ($P = .08$) for alertness to learning moments related to the general competencies, indicating that participants who received both the app and coaching reported the greatest alertness to learning moments (see Figure 1). No other interaction effects were found.

Frequency of reflection also varied between conditions. In the coaching conditions, app users tended to submit more cases than nonapp users. In the noncoaching conditions, app users tended to mention more learning moments on the reflection forms than nonapp users. Surprisingly, we found that app users who received coaching support made fewer entries in the app per working day than those who did not receive coaching support ($P = .05$). To explore the reason for this finding, we used additional data from the one-third of app users who categorized their app entries into reflections focused on the general competencies and those focused on the medical competencies. Entries made by those app users who received coaching support more often related to the general competencies (6.40 of 10.80 entries; 61.38% after correcting for the number of actual working days during the study; standard deviation [SD] = 0.28), which was the aim of the project, while entries by those app users who did not receive coaching support less often did so (3.08 of 13.83 entries; 19.72%; SD = 0.17). App

users in the coaching condition captured more relevant learning moments, while those in the noncoaching condition indicated that they did not often encounter (i.e., recognize) learning moments related to the general competencies. Likely, the coaching sessions provided a stimulus for participants to recognize such moments.

All app users captured an average of 12.41 learning moments in total (SD = 5.96), which included 10.84 text notes (SD = 5.00), 0.97 pictures (SD = 1.62), 0.50 audio recordings (SD = 2.31), and 0.09 videos (SD = 0.53). While all app users recorded text notes, only 13 included pictures (e.g., from an infected wound), 3 made an audio recording (e.g., an audio memo instead of a text note), and 1 made a video.

Participants who received both types of reflection support indicated during interviews that were not a part of the analysis reported here that they generally perceived the combination of app use and coaching sessions as highly useful.¹⁰ They found the two types of support to be complementary, as the meetings encouraged them to use the app more purposefully, while the app, in turn, helped them to collect higher-quality reflections to discuss at the meetings. Furthermore, they valued the app for its ease of use, which facilitated and encouraged real-time recordings of learning moments.

Next Steps

With this study, we have demonstrated that the introduction of a smartphone app into a workplace-based learning environment can bolster the frequency and intensity of residents' reflection

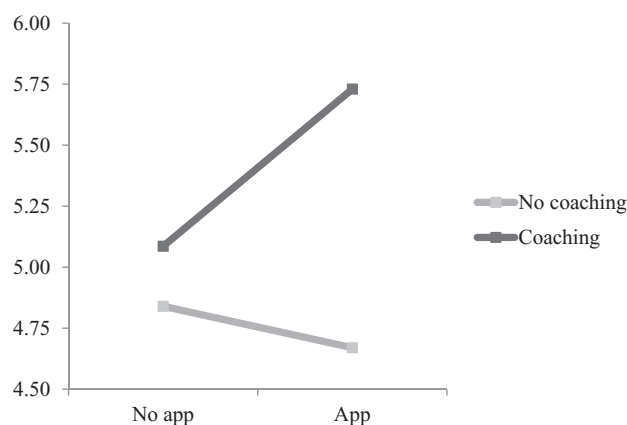


Figure 1 Interaction effect of a smartphone reflection app and coaching sessions on self-reported alertness to learning moments related to general competencies. The data show that the 14 residents who received the app and coaching support reported the highest levels of alertness.

Table 1
Means (M), Standard Deviations (SD), and 95% Confidence Intervals (CI) of the Measures of Intensity and Frequency of Reflection of 64 Residents, by Study Condition, in a Study of the Effects of App and Coaching Support on Reflection in the Workplace, Maastricht University, 2012

Measure	App without coaching (n = 17)			Coaching without app (n = 17)			App and coaching (n = 14)			No app and no coaching (n = 16)		
	M	SD	95% CI	M	SD	95% CI	M	SD	95% CI	M	SD	95% CI
Intensity of reflection												
Reflection scale ^a												
Pretest	3.97	0.56	3.68, 4.26	4.01	0.51	3.75, 4.28	3.66	0.40	3.43, 3.89	4.05	0.37	3.84, 4.26
Posttest	3.99	0.46	3.75, 4.22	3.88	0.49	3.63, 4.14	3.79	0.51	3.49, 4.08	3.75	0.37	3.53, 3.94
Amount learned from work ^b	3.12	0.93	2.64, 3.59	2.59	1.00	2.07, 3.10	3.21	0.80	2.75, 3.68	2.80	0.78	2.37, 3.23
Alertness to learning moments related to general competencies ^c	4.63	1.03	4.08, 5.17	5.18	0.73	4.80, 5.55	5.79	0.89	5.27, 6.30	4.73	0.88	4.24, 5.22
Learning activities related to general competencies ^d	4.63	0.72	4.24, 5.01	5.06	0.90	4.60, 5.52	5.21	0.80	4.75, 5.68	4.20	0.94	3.68, 4.72
Alertness to learning moments related to medical competencies ^e	5.00	0.82	4.56, 5.44	5.12	0.78	4.72, 5.52	5.43	1.02	4.84, 6.02	4.53	0.64	4.18, 4.89
Learning activities related to medical competencies ^f	4.75	0.78	4.34, 5.16	4.65	0.70	4.29, 5.01	4.79	0.89	4.27, 5.30	4.13	0.74	3.72, 4.54
Frequency of reflection												
No. of cases for coaching sessions	n/a	n/a	n/a	4.60	1.50	3.77, 5.43	5.82	1.54	4.79, 6.85	n/a	n/a	n/a
No. of cases on reflection forms	13.82	5.39	11.05, 16.59	n/a	n/a	n/a	n/a	n/a	n/a	10.21	4.76	7.47, 12.96
No. of entries in app per working day	0.48	0.20	0.38, 0.59	n/a	n/a	n/a	0.38	0.19	0.27, 0.49	n/a	n/a	n/a

Abbreviation: n/a indicates analyses that were not applicable.
^aSample item from the reflection scale used: "I often reflect on my actions to see whether I could have improved on what I did."
^bParticipants responded using a five-point scale, from totally disagree to totally agree.
^cParticipants responded to the item "By participating in this study, the amount I have learned from work increased" using a five-point scale, from totally disagree to totally agree.
^dParticipants completed the item "In the past six weeks, I was ... alert to situations and moments in which I could develop my general/medical competencies, compared to usual" using a seven-point scale, from much less to much more.
^eParticipants completed the item "In the past six weeks, I undertook ... actions to follow up on general/medical learning moments, compared to usual" using a seven-point scale, from much fewer to many more.

Table 2
Results of ANCOVA Tests Comparing Scores on Reflection Measures for 64 Residents in Four Study Conditions With Varying Degrees of Reflection Support, Maastricht University, 2012

Measure	Effect of app				Effect of coaching				Interaction effect app × coaching			
	F	df	P	η ²	F	df	P	η ²	F	df	P	η ²
Intensity of reflection												
Reflection scale	4.63	1, 57	.04	0.08	0.54	1, 57	.46	0.01	0.06	1, 57	.82	< 0.01
Amount learned from work	4.22	1, 57	.05	0.07	0.13	1, 57	.72	< 0.01	0.55	1, 57	.46	0.01
Alertness to learning moments related to general competencies	1.14	1, 56	.29	0.02	7.74	1, 56	.01	0.12	3.26	1, 56	.08	0.06
Learning activities related to general competencies	1.74	1, 57	.19	0.03	8.70	1, 56	.01	0.13	0.08	1, 57	.78	< 0.01
Alertness to learning moments related to medical competencies	3.37	1, 56	.07	0.06	2.93	1, 56	.09	0.05	0.04	1, 57	.84	< 0.01
Learning activities related to medical competencies	3.52	1, 56	.07	0.06	1.49	1, 56	.23	0.03	0.97	1, 57	.33	0.02
Frequency of reflection												
No. of cases for coaching sessions	3.24	1, 22	.09	0.13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
No. of cases on reflection forms	2.97	1, 27	.10	0.10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
No. of entries in app per working day	n/a	n/a	n/a	n/a	4.10	1, 27	.05	0.13	n/a	n/a	n/a	n/a

Abbreviations: F indicates F value; df, degrees of freedom; P, P value; η², value of eta squared as measure of effect size; n/a, analyses that were not applicable.

while enhancing their learning progress. Coaching sessions increased alertness to learning moments as well as the number of corresponding follow-up learning activities related to the general competencies. A combination of both types of support elevated this alertness further, emphasizing that the app and coaching sessions are complementary and mutually reinforcing.

With the app, residents could capture in real time learning moments for later in-depth reflection. In an environment where time for reflection is limited, like the clinical workplace, this feature is especially important. From our findings, we can conclude that smartphones have the potential to foster residents' professional development. Mobile technology has started to find its way into clinical workplace learning. However, research into the development and testing of reflection tools in medical education has been limited. We believe that this topic merits further exploration, as the flexible and creative use of the multimedia available on smartphones facilitates reflection and makes it more attractive to residents.⁷

Our study has a number of limitations, including a small sample size and the use of self-reported measures of

intensity of reflection. To overcome these limitations, future research should employ more robust measures to assess a larger population of residents. Expanding on our findings, we believe that mobile applications, by providing a close link between learning and workplace-based experiences, also could be used with residents' and students' personal digital portfolios as a means to monitor and plan professional development. Doing so may prevent trainees from viewing reflection as a mere add-on activity and, instead, promote synergy between education and workplace experiences to accomplish meaningful learning and improved practice.⁸ Therefore, we recommend that future studies of workplace learning focus on the integration of both a smartphone app and coaching sessions to encourage reflection.

Our findings demonstrate that a combination of types of support is most effective in encouraging reflection. The use of a simple mobile app to capture learning moments can bolster workplace-based learning, especially when used in conjunction with coaching sessions. With the use of mobile reflection tools, we envision new opportunities to strengthen the role of reflection in medical training,

optimizing its value for professional development.

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