Evaluating webinar-based training: a mixed methods study of trainee reactions toward digital web conferencing

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What are the reactions of training participants toward digital webinar-based training programs? Webinars are digital tools to deliver training and education through synchronous audiovisual communication among remotely located training instructors and participants. A webinar is a special case of web conferencing that serves the educational function of learning and teaching. Because the previous literature underemphasized the webinar process and qualitative learner experiences, the present study aimed to explore the reactions of 419 trainees toward 48 webinars in the four content areas supply chain management, industrial management, early childhood education and mathematics, the present study used a sequential mixed methods research design. The quantitative part of the study employed a multi-item online questionnaire to measure satisfaction and reactions toward the webinar trainer; survey responses were analyzed to estimate mean differences across webinars. The qualitative part of the study employed narrative interviews with 23 trainees; interview transcripts were analyzed with qualitative content analysis to identify how the instructional design, webinar content and implementation can be improved for future web conferences. The findings indicate that early childhood education trainees had the highest satisfaction levels. Trainees preferred greater levels of learner-teacher interaction, less time spent on discussing task solutions collaboratively and digital webinar recordings as a follow-up possibility at home or in the workplace. Trainees

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also liked the fact that webinars afforded the possibility to deepen the content, to prepare for upcoming exams and to have virtual consultation hours with the facilitator. Furthermore, trainees preferred webinars no longer than 90 min and webinars on weekdays after work rather than at weekends. Optimal internet/broadband connections were perceived as a requirement across web conferencing and virtual classroom programs for effective digital education. Implications of the findings for educational technology, human resource development and professional learning are discussed.

Introduction

Digital technologies are common choices nowadays for training and human resource development purposes (Cook *et al.*, 2010; Gegenfurtner *et al.*, this issue; Gegenfurtner *et al.*, 2013; Johnson *et al.*, 2011; Liu *et al.*, 2016; Nicklen *et al.*, 2016; Siewiorek & Gegenfurtner, 2010; Wang & Hsu, 2008). The webinar is one of many technological training tools. Gegenfurtner and Ebner (2019) define webinars as 'web-based seminars, in which students and teachers are connected live across distant geographical locations using shared virtual platforms and interact synchronously in real time via voice over IP and web camera equipment'. A webinar is a special case of web conferencing that serves the educational function of learning and teaching. In recent years, webinars have attracted increasing attention for training purposes (Cornelius, 2014; Cornelius & Gordon, 2013; Ebner & Gegenfurtner, 2019; Gegenfurtner & Ebner, 2019; Gegenfurtner, Schwab, & Ebner, 2018; McKinney, 2017; Means *et al.*, 2013; Wang & Hsu, 2008), largely because of their ability to connect geographically distant members by offering real-time training communication (Amhag, 2015; Gegenfurtner *et al.*, 2017; Johnson & Schumacher, 2016; Stout *et al.*, 2012; Zomenou *et al.*, 2015). However, empirical research examining webinars in contexts of training, human resource development and adult education are scarce. The few existing studies evaluate trainee satisfaction (e.g. Amhag, 2015; Polanco-Bueno, 2013); aspects such as technology-enhanced instructional design, training content or optimal modes of implementation tend to be deemphasized. This lack of empirical investigation is unfortunate because more detailed information about how to design, deliver and implement web conferencing tools in training and adult education would contribute to offering webinars that meet the needs of training participants and instructors and, ultimately, enhance training motivation and training effectiveness (Bell *et al.*, 2017; Gegenfurtner *et al.*, 2010; Gorges *et al.*, 2015; Knogler *et al.*, 2013; Noe, 2017; Quesada-Pallarès & Gegenfurtner, 2015; Schmidt-Hertha *et al.*, 2017; Segers & Gegenfurtner, 2013; Siewiorek *et al.*, 2013). As a remedy, this study contributes empirically to the research literature by offering evaluation outcomes that can help inform human resource development and educational practice when creating webinar-based training programs.

Webinars in training and development

Digitalization is a global trend that has also transformed the way in which training and adult education is designed, delivered and implemented (Bell *et al.*, 2017; Gegenfurtner *et al.*, 2014; Goe *et al.*, 2018; Martin *et al.*, 2014; McKinney, 2017; Schmid *et al.*, 2014; Testers *et al.*, 2015; Testers *et al.*, 2019). Among the digital tools and infrastructures for training, webinars are commonly applied in distance education and blended learning training programs. Trainees and trainers both report that they are satisfied with or enjoyed participating in webinar-based training (Cornelius & Gordon, 2013; Kear, *et al.*, 2012; Wang & Hsu, 2008).

In recent years, webinars have gained growing attention (Carrick *et al.*, 2017; Constantine, 2012; Gegenfurtner & Ebner, 2019; Gegenfurtner *et al.*, 2018; McMahon-Howard & Reimers, 2013; Nelson, 2010; Stout *et al.*, 2012) largely because webinars

offer synchronous online contexts that trainees can access ubiquitously from anywhere with internet connectivity. For example, Harned and Colleagues (2014) evaluated webinars in the context of mental health training. Their findings suggested that participants were most satisfied with consultations from the facilitator and being able to ask questions. Kanter *et al.* (2013) used webinars to simulate and train therapy situations. Their participants reported that they were most satisfied with the synchronous interaction, feedback and support from the facilitators and peer trainees. In a meta-analysis reviewing the effectiveness of webinars for training, Gegenfurtner and Ebner (2019) concluded that webinars were slightly more effective in promoting student achievement than were traditional face-to-face seminars and asynchronous training in learning management systems.

These studies (Carrick *et al.*, 2017; Constantine, 2012; Harned *et al.*, 2014; Kanter *et al.*, 2013; McMahon-Howard & Reimers, 2013; Nelson, 2010; Stout *et al.*, 2012) evaluated training effectiveness and are examples of how to use quantitative methodology to estimate and examine the extent to which webinar-based training environments develop trainee knowledge and skills (Ebner & Gegenfurtner, 2019; Gegenfurtner & Ebner, 2019). Still, although highly useful, aspects such as the instructional design during the webinar, the training content or how the webinar can be implemented tend to be deemphasized. Qualitative studies on webinar-based training exist (Amhag, 2015; Cornelius, 2014; Johnson *et al.*, 2011; Wang & Hsu, 2008); yet, these qualitative evaluations tend to have small sample sizes which limit the applicability and generalizability of their findings to other webinar-based training programs. To combine the best of both worlds – in-depth analyses of trainee reactions and widely applicable recommendations for future webinars – a mixed methods approach can help triangulate quantitative and qualitative data.

Mixed methods in training evaluation

Onwuegbuzie and Corrigan (2014) as well as Reio and Werner (2017) noted that mixed method research designs are becoming more and more frequent in research on training and human resource development. This increase is positive because mixed methods can account for a larger variety of empirical phenomena. Mixed method designs combine 'the best of both worlds' – quantitative large-sample studies and qualitative in-depth examinations (Creswell & Creswell, 2018; Schoonenboom & Johnson, 2017). Although an increase in mixed methods research has been noted, Onwuegbuzie and Corrigan (2014) note that the rate of mixed studies is still relatively low: since 2000, only 13% of the total number of empirical research articles published in the journal *Human Resource Development Quarterly* has represented mixed research studies. In the *International Journal of Training and Development*, examples of mixed methods research include Janssens and Colleagues' (2017) study on the relations between workplace conditions and informal learning outcomes among police officers as well as Collins and Colleagues' (2018) study on how leadership enabled creativity and agency in IT organizations.

A relatively infrequent use of mixed methods in the training and development literature seems surprising because mixed methods could help contextualize and triangulate, for example, quantitative survey items and qualitative interview narratives. In particular, surveys could be used to measure the satisfaction levels of trainees and interviews could be used to ask trainees about their reactions and experiences. Methodological reflections (Damşa *et al.*, 2017) and research guidelines like the ones noted above (Creswell & Creswell, 2018; Onwuegbuzie & Corrigan, 2014; Reio & Werner, 2017; Schoonenboom & Johnson, 2017) help popularize mixed methods research and offer valuable recommendations to increase the rigor of mixed method studies. It could thus be concluded that mixed methods are now an accepted standard in research on human resource development and adult education. However, their use in evaluating webinars – such as in training evaluation more generally – is still scarce. For this reason, the present study adopted a mixed methods design in the evaluation of trainee reactions toward digital web conferencing in training and development.

Purpose of the study

The purpose of the study was to evaluate the reactions of training participants toward webinars in order to contribute to the growing body of evidence on digital webinar-based training. In addition to estimating satisfaction levels, a particular interest was in analyzing how the evaluated reactions could be used to generate empirical, evidence-based recommendations for the delivery of webinars in training, adult education and human resource development (Johnson *et al.*, 2011; Wang & Hsu, 2008; Zomenou *et al.*, 2015). As the few empirical studies on webinar-based training either used quantitative or qualitative methods, the study adopted a mixed methods research design to combine the strengths of quantitative and qualitative approaches and to generate widely applicable recommendations for future webinar-based training programs. The research question was: what are the reactions of training participants toward digital webinar-based training?

Methods

To answer this research question and as noted, the present study adopted a mixed methods research design (Creswell & Creswell, 2018). Following the typology of Schoonenboom and Johnson (2017), this mixed methods study employed a planned equal-status independent sequential design with *a results point of integration*. Trainees volunteered to participate in the study; they received no compensation in the form of material rewards or study credit. Anonymity and confidentiality were guaranteed for all responses. The following sections describe the methods used in the quantitative and qualitative parts of the study. The quantitative part was a multi-item survey study and the qualitative part was a narrative interview study.

Quantitative part

This section presents the methods used in the quantitative part of the study, including a description of the sample, the survey data collection and the statistical analysis.

Sample and context
Participants in the quantitative part of the study were N_{quan} = 419 trainees who were enrolled in four different webinar-based, off-the-job training programs designed and administered at a large training center for adult and continuing education in Southern Germany. The training center is part of a higher education institute and offers numerous academic courses for non-traditional students on evenings and weekends that participants attend off-the-job in addition to their regular work duties (Gegenfurtner *et al.*, 2017). The four programs varied in training content and length: the first training program was a nine-month certificate course on supply chain management; the second training program was a nine-month certificate course on industrial management; the third training program was a five-month course on early childhood education; and the fourth training program was a one-month course on mathematics. Training participation was voluntary (Gegenfurtner *et al.*, 2016). The training programs were designed using a blended learning approach, including face-to-face meetings in traditional classrooms, asynchronous online communication in a learning management system and synchronous webinars. All webinars were implemented identically, with knowledge-centered and student-centered training elements, and delivered using the Adobe Connect infrastructure. The number of webinars varied in each training, with nine webinars on supply chain management, seven webinars on industrial management, 23 webinars on early childhood education and eight webinars on mathematics. Table 1 presents the number of participants and webinars per training content. The duration of the single webinars ranged from 45 to 120 min. All webinars were organized between 14 June 2016 and 30 August 2018.

Survey data collection
To evaluate each webinar-based training event, participants were invited to complete an online questionnaire immediately after each webinar. Participants were asked how

Training content	N participants	N webinars	M (SD) of participants per webinar
Supply chain management	107	9	11.89 (3.22)
Industrial management	62	7	8.86 (4.91)
Early childhood education	191	23	8.30 (4.77)
Mathematics	59	8	7.38 (3.16)
Total	419	48	8.91 (4.44)

Table 2: Item wording, means and standard deviations

Item	Wording	M	SD
Satisfaction 1	Learning was fun	3.28	0.81
Satisfaction 2	I felt comfortable in the webinar	3.44	0.73
Satisfaction 3	I have learned a lot	3.42	0.76
Satisfaction 4	The time was used efficiently	3.47	0.71
Trainer 1	The trainer gave warm feedback	3.76	0.51
Trainer 2	The trainer answered my questions	3.59	0.60
Trainer 3	The trainer dealt constructively with comments	3.74	0.49

much they agreed with different survey items using a 4-point Likert scale, with 1 = *not at all* to 4 = *very much*. The survey included seven items that were developed for this study. Item development was performed collaboratively in our researcher team and grounded in interest to measure affective reactions toward the webinar-based training programs. Four items measured the overall satisfaction of the participants with the webinar and another three items measured trainee reactions toward the trainer who administered the webinar. Table 2 presents all item wordings, means and standard deviation estimates.

Statistical analysis
Descriptive statistics were used to estimate the means and standard deviations of each item. Missing data were deleted from the list. Exploratory factor analysis with Maximum Likelihood as the extraction method and Direct Oblimin as the rotation method were used to identify the factor structure behind the data. Differences in item and factor means per training content were calculated using one-factorial analysis of variance with the software program SPSS 24. An alpha level of $p < 0.05$ was used for the statistical tests reported.

Qualitative part

This section presents the methods used in the qualitative part of the study, including a description of the sample, the data collection and the qualitative content analysis.

Sample
From the pool of 419 participants that were included in the quantitative part of the study, a total of N_{qual} = 23 trainees were asked to additionally participate in the qualitative part. Of these, 14 were female (60.87%) and 9 were male (39.13%). Their average age was 36.92 years (SD = 8.14). Participants were selected using Onwuegbuzie and Leech's (2007) *maximum variation sampling scheme*; the goal was to represent in the sample as high of a variance in demographic characteristics as possible, including their age, gender and home town.

Interview data collection
Data were collected using narrative, post-training interviews. The objective of the interviews was to contextualize the quantitative survey items and to offer in-depth narratives of trainee reactions. Three questions guided the interviews with the trainees: (1) what did you like about the webinars, (2) what did you dislike and (3) in your opinion, how can the webinars be improved in the future? These questions were identical for all trainees. The interviews were conducted individually, face-to-face. A total of 23 interviews were conducted. The total duration of all interviews was 423 min ($M = 18.78$, $SD = 7.07$). Talk during the interviews was recorded digitally and a trained assistant transcribed the interview recordings verbatim.

Qualitative content analysis
The interview data were analyzed following the procedures of Mayring's (2014) qualitative content analysis. The goal was to structure the interview content to identify common themes and categories to help improve webinar-based learning environments. The coding units were single sentences and sentence fragments, and the recording units were individual interviews. Mayring (2014) specifies three steps in his qualitative content analysis: summary, explication, and structuring. In the first step, the summary, sentences and sentence fragments from individual interview transcript were paraphrased and condensed; redundant text material was removed and content-bearing text material was abstracted. In the second step, the explication, single words or text fragments that were not immediately clear were further interpreted and explained in a narrow contextual analysis using lexical-grammatical definitions and in a broad contextual analysis using the additional interview material that emerged before or after the text fragment that needed explication. In the third and final step, the structuring, a category system was developed and extracted from the summarized and explicated interview material from all 23 interviews. The development of the category system was performed by two trained raters; intercoder reliability was appropriate, with Cohen's $\kappa = 0.89$. Conflicting codings were resolved through consensus.

Results

In this section, we present the outcomes of the quantitative survey study and of the qualitative interview study and then integrate these two bodies of findings to help answer the overall research question of how trainees reacted to the attended webinars.

Survey findings

Table 3 presents the inter-item correlation matrix. The correlation coefficients were all below 0.80, thus indicating a low likelihood of multicollinearity. The descriptive analyses of the survey responses demonstrate that, overall, participants were satisfied with the webinar and the webinar trainer. All items had mean estimates of ≥3.28, which is high when considering the 4-point Likert scale. The highest rated item was 'The

Table 3: Inter-item correlation matrix

	1	2	3	4	5	6
1. Satisfaction 1	–					
2. Satisfaction 2	0.78	–				
3. Satisfaction 3	0.66	0.59	–			
4. Satisfaction 4	0.54	0.59	0.47	–		
5. Trainer 1	0.38	0.41	0.34	0.35	–	
6. Trainer 2	0.44	0.46	0.42	0.38	0.48	–
7. Trainer 3	0.36	0.42	0.38	0.37	0.62	0.50

Note: N = 419. All correlations p < 0.001.

trainer gave warm feedback' ($M = 3.76$, $SD = 0.51$). Figure 1 shows a graphical representation of the mean estimates of all items, indicating that the four satisfaction items were rated consistently lower (all below 3.50) compared to the three trainer reaction items (all above 3.50).

Figure 2 presents the mean estimates of all items per training content. The highest ratings were obtained in the webinars associated with early childhood education. In comparison, the lowest ratings were obtained in webinars associated with mathematics. Across training contents, analyses of variance demonstrated statistically significant differences for five of the seven items, as shown in Table 4.

Outcomes of the exploratory factor analysis indicated that the seven items loaded on two factors: satisfaction (Cronbach's $\alpha = 0.86$) and trainer reaction (Cronbach's $\alpha = 0.76$). Table 5 shows the factor loadings. Interfactor correlation was 0.62, $p < 0.001$. One-factorial analyses of variance were used to calculate differences in factor means per training content, with $F (3, 416) = 1.927$, $p = 0.125$ for satisfaction and $F (3, 416) = 11.898$, $p < 0.001$ for trainer reaction.
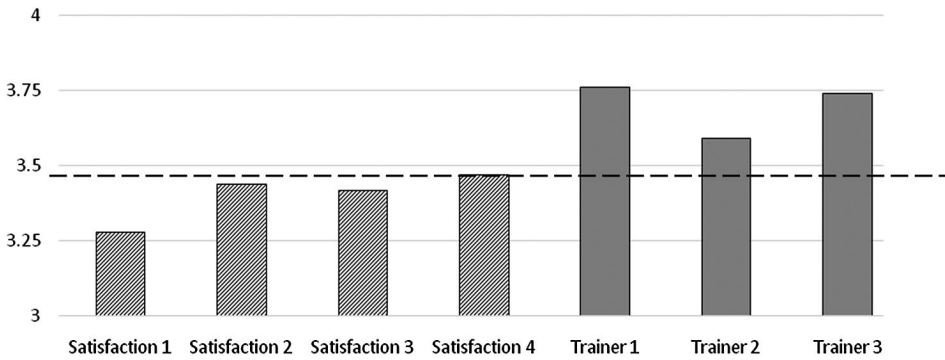

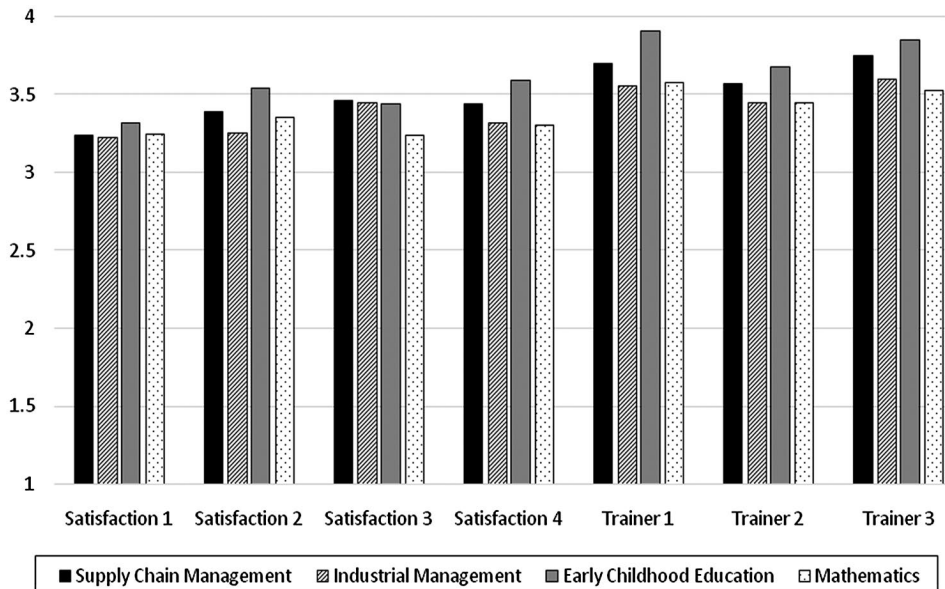Figure 1: Mean estimates of overall satisfaction and trainer reactions.

Figure 2: Mean estimates of all items per training content.

Table 4: Comparison of item means per training content

	Supply Chain Management		Industrial Management		Early Childhood Education		Mathematics		ANOVA
	M	SD	M	SD	M	SD	M	SD	
Satisfaction 1	3.24	0.79	3.23	0.80	3.32	0.85	3.25	0.73	$F = 0.306, p = 0.821$
Satisfaction 2	3.39	0.76	3.26	0.77	3.54	0.72	3.36	0.66	$F = 2.853, p = 0.037$
Satisfaction 3	3.46	0.76	3.45	0.65	3.44	0.79	3.24	0.82	$F = 1.293, p = 0.276$
Satisfaction 4	3.44	0.74	3.32	0.79	3.59	0.65	3.31	0.68	$F = 4.013, p = 0.008$
Trainer 1	3.70	0.50	3.56	0.74	3.91	0.30	3.58	0.62	$F = 12.708, p < 0.001$
Trainer 2	3.57	0.55	3.45	0.69	3.68	0.58	3.45	0.60	$F = 3.731, p = 0.011$
Trainer 3	3.75	0.43	3.60	0.59	3.85	0.42	3.53	0.60	$F = 9.347, p < 0.001$

Item	Factor 1	Factor 2
Satisfaction 1	**0.976**	−0.118
Satisfaction 2	**0.847**	0.021
Satisfaction 3	**0.690**	0.050
Satisfaction 4	**0.559**	0.122
Trainer 1	0.024	**0.727**
Trainer 2	0.229	**0.485**
Trainer 3	−0.071	**0.876**

Table 6: Category system

Main category	Sub category	Anchor example
Instructional design	Trainee-trainer interaction	I don't mind listening passively to the trainer but sometimes I would have liked a bit more interaction
	Rapid task discussion	Sometimes everybody presented their task solution. This was like … I don't wanna say boring, but it does take a while then
	Digital recording of webinars	Like, when you have to work longer, you can watch the webinar afterwards and catch up immediately. This was super that this was recorded and you could watch it in a relaxed mood
Content	Deepening of content	What I liked was that you could deepen what you have learned in the face–to–face lessons
	Exam preparation	Webinars are really really great to prepare for the next exams
	Virtual consultation hours	I liked webinars when we used them for consultation, to clarify questions
Implementation	Geographical flexibility	With the webinars, it was very comfortable that you could do them at home. There's no need to drive from A to B
	Length of max. 90 min	90 min, like, two instructional units, this worked pretty well for me
	After work webinars	After work is perfect during the week. Ideally between 6:30 and 8 p.m. Then the whole weekend is freetime
	Fast internet connection	Sometimes we had the problem that the broadcast was not so optimal, or the frame froze, or we couldn't hear the trainer. Then they restarted the system and then it worked again. I guess this was because of the speed of the internet connection

Interview findings

The qualitative analyses were based on three interview questions: what did you like in the webinar, what did you dislike and what could be improved in future webinars? Responses to these three questions were clustered into three main categories: instructional design, content and implementation. Table 6 presents the category system. All categories are described in detail below.

Instructional design

The first main category, instructional design, contained three subcategories: trainee-trainer interaction, rapid task discussion and digital recording of webinars. First, participants articulated the wish for more interaction with the trainer and with other peer trainees during the webinar sessions. Trainers often used direct instruction and gave presentations, similar to teaching in a large lecture hall. Although some trainees articulated that they were in favor of knowledge-centered instruction using trainer presentations, other trainees argued that they wished the instructional design was more learner-centered and included diverse interactive elements. As M1 put it, 'I don't mind listening passively to the trainer but sometimes I would have liked a bit more interaction'. This wish for more frequent trainee-trainer interactions was expressed in all four training programs.

Second, participants appreciated that tasks were solved during the webinar and those task solutions were discussed collaboratively. However, according to trainees, the time for task discussion could be shortened. M2 said he 'had to wait five minutes until we continued'; he used the time waiting to engage with off-topic activities. Similarly, S1 stated that 'sometimes everybody presented their task solution. This was like … I don't wanna [sic] say boring, but it does take a while then'. For future webinars, participants – particularly in the programs on supply chain management and mathematics – wished for a quicker turnaround time when tasks and task solutions are discussed.

Third, many participants appreciated the digital recording of the webinars which afforded possibilities to follow up on the webinar content. As E1 put it, 'So, for me, it was sometimes quite convenient that the webinars were recorded'. Another affordance of webinar recordings was that participants who could not attend the webinar at the set date and time could later follow up on what was taught and discussed. Many participants in all training programs perceived this as a positive feature. For example, S1 said, 'Like, when you have to work longer, you can watch the webinar afterward and catch up immediately. This was super that this was recorded and you could watch it in a relaxed mood. 'To summarize, participants wished for a more learner-centered instructional design with higher levels of trainee-trainer interaction; they asked for less time spent on discussing task solutions collaboratively; and they enjoyed and appreciated the digital webinar recordings as a follow-up possibility.

Content

The second main category, content, included three subcategories: deepening of content, exam preparation and virtual consultation hours. First, webinars were perceived as viable opportunities to deepen content from previous training sessions. This reaction was articulated in the mathematics and industrial management programs. For example, M2 said that 'webinars were really great to deepen content we already learned I1 argued that webinars were less suited for difficult or complex topics, but more for repeating and deepening previously covered content. She said, 'What I liked was that you could deepen what you have learned in the face-to-face sessions. Because you simply have the time to deepen things … and you have already once engaged with the training content and simply know where are my weaknesses in which I have problems still, and then you can talk to the trainer about where I am stuck'.

Second, webinars were perceived as a chance to prepare for upcoming exams and assessments, particularly in the case of early childhood education. According to E1, 'webinars are really really great to prepare for the next exams'. She wished, however, that webinar dates were not too close to the exam dates so that there was still enough time to prepare. As E2 said, 'it's not optimal when webinars are too close to exams … when the trainer had his last lecture, that the webinar is relatively soon after and not so close to the actual examination'. This would further optimize webinars as tools for exam preparation.

Third, webinars were also perceived as ways to have virtual consultation hours with the trainers. This subcategory emerged in all training programs. For example, E2 said that webinars offered 'a safe space for question clarification', and E3 liked webinars

because 'you could talk conveniently from home'. To summarize, trainees liked that webinars afforded the possibility to deepen content, to prepare for upcoming exams and to have virtual consultation hours with the trainer.

Implementation

The third main category, implementation, contained four subcategories: geographical flexibility, length of maximum 90 min, after-work webinars, and fast internet connections. First, all interviewed trainees from all training programs appreciated the geographical flexibility that webinars afforded. M3 used the possibility to participate in the webinar at his workplace; he did not need to travel home or to the training center. I2 said, 'Generally, I like webinars because I can do them at home on the sofa'. And S2 stated, 'With the webinars, it was very comfortable that you could do them at home. There's no need to drive from A to B. I think this helped many to integrate the training program with daily work'. The ubiquity of webinars and the reduced need for traveling was deeply appreciated.

Second, trainees thought it was ideal when webinars had a length of 90 min. S2 said that '90 min, like, two instructional units, this worked pretty well for me'. In addition, M4 articulated that 90 min was a very good length; this helped keep attention high. Longer webinars were perceived as too demanding or, conversely, too dull.

Third, in terms of time, webinars were preferred when they were set on weekdays after work. Most participants were very precise and preferred a time from 6:30 to 8.00 p.m. As I4 put it, 'After work is perfect during the week. Ideally between 6:30 and 8.00 p.m. Then the whole weekend is free time'.

Finally, a technical aspect of the implementation concerned the internet connectivity needed for webinars. S4 described the following scenario: 'Sometimes we had problems that the broadcast was not so optimal, or the frame froze, or we couldn't hear the trainer. Then they restarted the system and then it worked again. I guess this was because of the speed of the internet connection. There we sometimes had problems. This is quite inconvenient when you are sitting there and lose connections'. Particularly in larger webinar groups, it was highly recommended to make sure that every participant and the trainers have an adequate broadband connection with high speed. This can help minimize slow webinars and reduce any technical problems. To summarize, participants preferred webinars no longer than 90 min and webinars on weekdays after work rather than on weekends; the geographical flexibility afforded by webinars was appreciated. Optimal internet/broadband connections were perceived as a requirement across training programs.

Integration of quantitative and qualitative findings

This section aims to integrate the quantitative item responses with the qualitative interview responses. When analyzing the interview data and questionnaire data together, three themes emerged. First, it was evident that reactions toward the trainer were positive. All three trainer items scored above average. Still, although the survey data suggested high levels of satisfaction toward the trainer, the interview data indicated that there is still room for improvement. Particularly, some trainees asked for more interaction with the trainer and more learner-centered instruction. This wish was especially prevalent in the mathematics program. Interestingly, the mathematics trainees had scored relatively low, compared to the other programs, in the three trainer items on the questionnaire. This pattern of findings seems to suggest that reactions toward trainers can be even further improved when interaction levels are increased.

A second theme that emerged from the triangulation of results had to do with the efficient use of time. Satisfaction item 4 represented the ideal that the time during the webinar was used efficiently, with higher scores in supply chain management and early childhood education compared with industrial management and mathematics. Considering the qualitative data, participants in the mathematics program articulated that the collaborative discussion of individual task solutions took too much time; to speed up progress, they asked to reduce the temporal resources invested in discussing

everyone's task solution. This dissatisfaction seems to be reflected in the low scores on Satisfaction item 4. Surprisingly, in the case of supply chain management, this was not the case: although participants raised similar concerns on time management as the mathematics trainees did, their item scoring was still rather high. It can be speculated that, in summary, supply chain management trainees were still satisfied overall with how the time was used during the webinar.

Finally, when comparing the item scores across training contents, it was evident that early childhood education trainees scored higher than trainees in other programs on six out of seven items, only scoring second on Satisfaction item 3 ('I have learned a lot') with $M = 3.44$ ($SD = 0.79$), behind industrial management with an $M = 3.45$ ($SD = 0.65$). This seems to suggest that early childhood education trainees were more satisfied than other trainees. In the qualitative interview material, however, this trend could not be supported, as the interview narratives from the early childhood education trainees were not much different than the narratives from trainees in the other three programs. It can be assumed, therefore, that the disciplinary background influenced the response pattern in the survey items, with generally higher scores from preschool educators compared to managers or scientists.

Discussion

This study aimed to answer the research question of what the reactions of training participants were toward digital webinar-based training programs (Bell *et al.*, 2017; Ebner & Gegenfurtner, 2019; Gegenfurtner & Ebner, 2019; McKinney, 2017; Noe, 2017; Schmidt-Hertha *et al.*, 2017; Wang & Hsu, 2008). Using a mixed methods research approach (Creswell & Creswell, 2018; Schoonenboom & Johnson, 2017), the study evaluated a total of 48 webinars with 419 participants in four content areas to produce several main findings, recommendations for educational practice, study limitations and directions for future research.

Main findings

The study findings contribute to our understanding of trainee needs, preferences and satisfaction levels in the context of webinar-based training programs as they relate to the technology-enhanced instructional design, content and implementation of webinars. The present study fills a gap in the literature because research on webinars for training and human resource development is scarce; the study addresses this research gap by considering the perspectives of training participants using a mixed methods design.

One main finding is the positive reaction of trainees across content areas that webinars afford ubiquitous access to training material and thus offer high levels of geographical flexibility. This flexibility was deeply appreciated and might have been one of the reasons why satisfaction scores were so positive. Generally, this finding contributes to the empirical evidence reported in previous research literature on technology-enhanced training using digital and blended learning designs, indicating that trainees perceive digital modalities – including webinar-based training programs – positively (Amhag, 2015; Cornelius & Gordon, 2013; Gegenfurtner *et al.*, 2019; Johnson & Schumacher, 2016; Polanco-Bueno, 2013; Wang & Hsu, 2008). Specifically, the qualitative data material indicates how satisfied the trainees were with direct, synchronous communication with the facilitators and peer students – a finding that confirms previous research findings (e.g. Harned *et al.*, 2014; Kanter *et al.*, 2013; Wang & Hsu, 2008). Still, even if trainees were satisfied with the evaluated webinars, we should note that Ebner and Gegenfurtner (2019) reported trainees to be even more satisfied in face-to-face instruction compared with webinar instruction.

Another main finding relates to an advanced understanding of evaluation outcomes when qualitative and quantitative sources of data are mixed and integrated. The use of mixed methods in the literature on training and human resource development is increasing (Collin *et al.*, 2018; Damşa *et al.*, 2017; Janssens *et al.*, 2017; Onwuegbuzie & Corrigan, 2014; Reio & Werner, 2017) and this study contributes to this methodological

trend by considering survey data and interview narratives in a technology-enhanced training context. More precisely, in the present study, the mixing of methods has helped in interpreting the item responses through additional information that would not have been available to evaluators and researchers who use mono-method designs (Creswell & Creswell, 2018; Schoonenboom & Johnson, 2017).

Finally, the study produced several specific ways for how webinars can be improved as digital learning environments for trainees. These implications for webinar design and implementation are associated with the interview narratives which reflect the particular wishes and preferences of the sampled participants. Past research indicated that webinars are not always successful in promoting learning outcomes or in increasing satisfaction levels in comparison to face-to-face classrooms (Alnabelsi *et al.*, 2015; Carrick *et al.*, 2017) and asynchronous learning management systems (Constantine, 2012; Olson & McCracken, 2015). It is thus relevant to use the presented evidence and translate it into implications for educational technologists. The next section presents these recommendations for educational practice in greater detail.

Recommendations for educational practice

Grounded in the qualitative interview narratives, trainers, human resource developers and educational technologists can use the study findings for the development, refinement and implementation of webinar-based training programs. Because webinars have attracted increasing attention for training and development purposes in recent years, evidence-based recommendations for webinar delivery are important to increase digital training effectiveness. If we assume that webinars are used across training settings and if we further assume that different training providers implement webinars in their curricula for their target groups, then the study implications are applicable to varied training contexts, including continuing academic education in universities, further education on and off-the-job and human resource development in corporate organizations. In particular, the findings can be used to abstract several recommendations, as they relate to the instructional design, webinar content and practical implementation.

First, for the instructional design, practitioners can aim to increase the interaction between trainers and trainees. Several webinar infrastructures (e.g. Adobe Connect, Cisco WebEx, Zoom) offer tools to increase participation levels and foster learner-centered instructional designs. Among these tools are polls and discussion boards. Having more and more frequent, interactions can help increase satisfaction levels and, ultimately, contribute to higher levels of learning and transfer. Furthermore, trainers should aim to minimize the time needed to discuss task solutions collaboratively and aim to offer recordings of the webinar session for those participants who could not attend on the original date.

Second, for content development, practitioners can use webinars as a tool for exam preparation; this affords space for the trainees to clarify questions and address any problems or knowledge gaps. Similarly, trainers can offer webinars as virtual consultation hours; this helps reduce the time and money needed for traveling to meet face-to-face. Trainees also felt that webinars should not be used for overly complex or difficult content, but rather to deepen what has already been covered in face-to-face classroom sessions.

Finally, for implementation, practitioners can aim to schedule webinars with a length of approximately 90 min in the early evening of weekdays. If longer webinars are needed, it can be useful to schedule pauses and breaks to help trainees recover their attentional resources. Trainees also articulated that fast internet connections are essential for webinars to be held without technical problems; this is particularly important when webinars are organized for large groups of trainees.

Limitations and future research directions

The study had several limitations that should be noted. The first limitation is that the findings are based on the evaluation results of one particular training center. Although

the coverage of four different programs of varying training content sought to lessen this bias, generalizability to other training programs might be limited. Similarly, trainees had a Central European background, which can limit the generalizability of the study findings and practical recommendations to participants from other countries, regions or cultures. Participants completed the questionnaires repeatedly after each webinar, so familiarity with the webinar environment can have moderated the reaction measures. Finally, a limitation concerned the quantitative survey items which measured overall satisfaction; future research could measure different subdimensions of satisfaction, including but not limited to satisfaction with technology, the course web site or the training instruction (Bolliger & Martindale, 2004; Gegenfurtner *et al.*, 2009). Directions for future research thus include replication of this evaluation in different contexts to estimate how stable the study findings are across countries and cultures. Another direction for future research concerns the examination of trainee reactions when the instructional design is systematically varied. For example, studies could compare knowledge-centered and learner-centered designs in webinars and measure satisfaction (Amhag, 2015; Ebner & Gegenfurtner, 2019; Gegenfurtner *et al.*, 2009; Kanter *et al.*, 2013), motivation (Gegenfurtner, 2018; Gegenfurtner *et al.*, 2019; Gorges *et al.*, 2015), achievement (Cook *et al.*, 2010; Gegenfurtner & Ebner, 2019; Schmid *et al.*, 2014), and transfer (Froehlich & Gegenfurtner, 2019; Gegenfurtner *et al.*, 2019; Laine & Gegenfurtner, 2013; Reinhold *et al.*, 2018). Finally, it would also be interesting to estimate, using the same questionnaire items, how the reactions to webinar instruction would compare with reactions to face-to-face classroom instruction, using different teaching modalities for content delivery (Cook *et al.*, 2010; Gegenfurtner *et al.*, 2013; Liu *et al.*, 2016; Means *et al.*, 2013; Schmid *et al.*, 2014).

Conclusion

What are the reactions of training participants toward webinar-based training environments? And how can the evaluation results of trainees be used to improve the design of future webinars? This study integrated qualitative interview data and quantitative survey data in a sequential mixed methods research design to evaluate 48 webinars with 419 trainees who participated in four different training content areas, including supply chain management, industrial management, early childhood education and mathematics. The study findings can help educational technologists and human resource developers in the design, development and implementation of digital technology-enhanced training.

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