



# Comparing Instructional Event Sequences in Audio Podcasts with Low Versus High User Satisfaction

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## Abstract

According to Gagne, instruction should follow the prescribed nine events of instruction, but that the sequence need not be absolute and that not all events are necessary. The purpose of this study was to determine to what extent are the prescribed sequence implemented in practice, and how might variations in event sequences affect learner satisfaction. Using sequential analysis, this study identified patterns in instructional event sequences observed in iTunes audio podcasts with low versus high user satisfaction ratings. The analysis revealed that collectively the audio podcasts followed the event sequence prescribed by Gagne. However, the high-rated podcasts were more likely to transition from objectives straight to information presentation (skipping stimulating recall) and from information presentation to practice (skipping guidance). If learners were using the podcasts to support just-in-time learning and were aware that they could return to the podcasts at any time in the future, there was no need to stimulate recall and receive guidance to improve long-term memory and recall. These findings suggest that event sequences should be modified to accommodate different instructional contexts in order to increase learner satisfaction and efficiency. This study and its findings also serve to illustrate ways to apply sequential analysis to conduct further investigations on ways to vary instructional event sequences to optimize both process and learning outcomes.

**Keywords** Events of instruction · Audio podcast design

## Introduction

To design more effective instruction, Gagné (1985) developed the nine events of instruction model to describe the instructional events and event sequences required to elicit the cognitive processes (e.g., attention, coding, retrieval) used to achieve successful learning for any type of learning outcome. These nine events of instructions in their recommended order are gaining attention, informing the learner of the objective, stimulating recall of prerequisite learning, presenting the stimulus material, providing learning guidance, eliciting the performance, providing feedback, assessing the performance, and enhancing retention and transfer. The first event is to gain learner's attention with a compelling introduction or surprise

in order get unmotivated or distracted learners to engage with the instruction. The second event is to inform learners of the learning objectives to establish the instructional benefits and the reasons to engage with the instruction. Stimulating recall provides opportunities for the learner to recall and connect prior skills and experiences with the new information in order to increase long-term memory and recall of the new information. The instructional content is then carefully presented to learners to help them achieve the stated objectives. Next, guidance is provided to help learners acquire the new information to prevent confusion and learner frustration. Opportunities to practice repetitive performance and application of the new information enables learners to better retain the information. Providing feedback on learner's performance then enables learners to identify their strengths and weaknesses and take the necessary actions to address the weaknesses in order to achieve the goals. Assess the learners to help identify the gap between learners' knowledge and target knowledge so that appropriate actions can be taken to address the gap. Finally, enhance recall and transfer by helping learners identify when and how to apply the new information to real-world applications beyond the instructional materials presented to the learner.

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According to Gagne, instruction should in general follow this prescribed sequence of events, but the event ordering can be altered and that not all events are necessary depending on the type of learning outcome to be achieved. Studies that examine Gagne's events of instruction largely test the effects of each type of instructional event alone or in combination with two or more other instructional events (and their associated teaching activities) on student learning, attitudes, and study time across different instructional contexts such as computer-based instruction, multimedia presentations, and classroom instruction. For example, Martin and Klein (2008) examined the relative effects of objectives, information, practice with feedback, and review on achievement, attitude, and study time in multimedia instruction. Their study found that instruction without practice produced lower learning than with practice, instruction with information as the only instructional event produced the lowest scores, objectives and review had no significant effect, and that students perceived information presentation, practice, and review to be more helpful than statement of objectives.

However, no studies at this time have empirically tested and determined how variations in the *sequencing* of instructional events (which can include the omission of events within event sequences) affect the learner and learning outcomes. One possible reason as to why no such studies have yet been conducted to address the effects of event sequencing is because: 1) there are a large number of possible permutations in event sequences between the nine events; and 2) conducting controlled studies to compare the effects of each variation in event sequence on a specific learning outcome using a sufficient number of participants per variation/condition makes such studies logistical infeasible. Furthermore, existing analytical methods and software tools used to identify patterns in event sequences and the associations between identified sequential patterns and specific outcomes have yet to be fully disseminated, adopted, and applied by educational researchers specializing in instructional design research.

Given these challenges, the purpose of this study was to use the method of sequential analysis (Bakeman and Gottman 1997) to identify potential associations between certain event sequences and outcomes. In this study, the event sequences exhibited in iTunes audio podcasts are identified among a set of audio podcasts that received either low or high user ratings. Sequential analysis was used to identify unique patterns in event sequences found in low-rated and in high-rated audio podcasts, thus enabling a side-by-side comparison of the observed patterns to determine where event sequences differ between the low- versus high-rated audio podcasts. Using this approach, this study addressed the following questions:

1. To what extent are the prescribed event sequences implemented in audio podcasts?
2. Which variations in event sequencing are associated with audio podcasts with low versus high user satisfaction ratings?

## Method

**Data Collection** Thirteen educational audio podcasts with user ratings ranging from 2 to 3.5 were randomly selected from iTunes to examine the event sequences used in low-rated audio podcasts. Likewise, thirteen educational audio podcasts with user ratings from 4 to 5 were randomly selected and used to examine the event sequences used in high-rated podcasts. Among Gagne's five learning outcomes/categories, the 26 audio podcasts were either teaching verbal (e.g., foreign language, grammar) or intellectual skills (e.g., financing, technology skills) with none of the podcasts addressing cognitive strategies, attitudes, or motor skills. The cutoff point was set at 3.5 because podcast ratings on iTunes averaged 3.68 (median = 4). For each event observed in a given podcast, the event (identified by event numbers from 1 through 9) was recorded into a single spreadsheet column (entered in chronological order from top to bottom). With each recorded event, the coder also entered a short summary description of the narrated content that was given the assigned instructional event. A second coder coded the narrative descriptions and a comparison of the coded events between the two coders revealed good inter-rated reliability across all nine events with weighted Cohen's Kappa of .742 at 79.25% agreement. The main source of disagreement occurred when determining whether rhetorical questions were presented to gain attention, elicit recall of prior experiences, or increase retention depending on the time and place within a podcast. Next, the event sequences and chronology for all the low-rated podcasts were aggregated into a single spreadsheet column for identifying sequential patterns in the low-rated podcasts. Likewise, the event sequences and chronology for all the high-rated podcasts were aggregated into another single spreadsheet column for identifying sequential patterns in the high-rated podcasts.

**Data Analysis** The method of sequential analysis (Bakeman and Gottman 1997) was used to identify patterns in instructional event sequences by determining: 1) the number of times each given event was followed immediately by each of the other possible events (e.g., Attention → State Objectives); 2) the relative frequencies or *transitional probabilities* between the events that measure how likely one event is followed by another specific event relative to all possible events; and 3) which observed probabilities are higher and lower than the expected probabilities based on *z*-score tests formulated by Bakeman and Gottman (pp. 108–111) under the assumption that ensuing events occur with equal probability while taking the observed frequencies of each individual event into

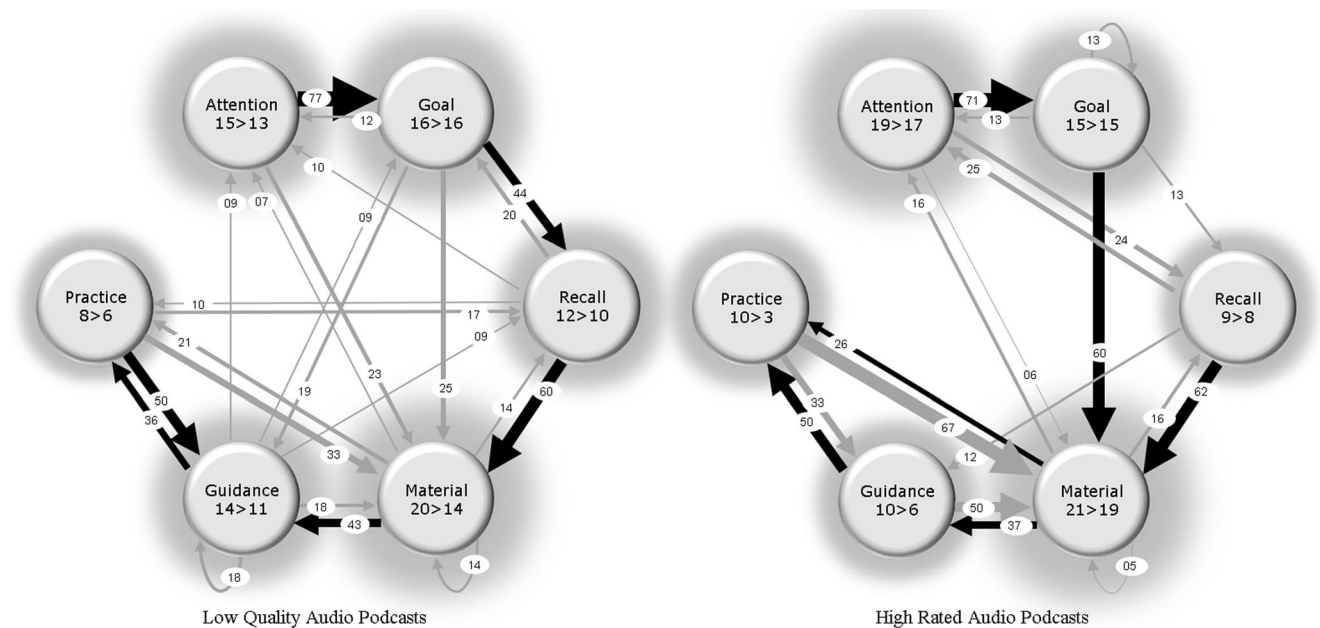
consideration. To conduct this analysis, the aggregated event sequence data was imported into the Discussion Analysis Tool software (Jeong 2018) to tally the frequencies, compute the transitional probabilities between the events, compute the z-scores to determine at  $p < .05$  which observed probabilities were significantly higher and lower than the expected probability, and to generate transitional state diagrams to visually discern differences in sequential patterns between the low- versus high-rated audio podcasts.

This analysis produced the left transitional state diagram in Fig. 1 that reveals the sequential patterns in the events observed in the low-rated audio podcasts, while the right transitional state diagram reveals the sequential patterns observed in the high-rated audio podcasts. In the state diagrams, the arrows reveal which events were most likely to follow any one given event. For example, the top-most arrow in the left state diagram shows that 77% of all events following Attention were Stating Goals. Arrows presented in black identify probabilities that are significantly higher than the expected probabilities to reveal a sequential “pattern” within the state diagram. The arrows in gray identify probabilities that were not significantly higher than expected and hence cannot be determined to be a definitive pattern. The thickness of each arrow reflects the relative size of the observed probability with thicker lines for higher probabilities and thinner lines for lower probabilities. The first value presented within a node identifies the frequency of occurrence of the given event. The second value presents the total number of events that immediately followed the given event. The size of the halo

surrounding each node conveys the relative frequency of each given event within the group (low vs. high-rated audio podcasts).

### Main Findings & Discussion

The left transitional state diagram in Fig. 1 shows that low-rated podcasts generally followed the first six events of instruction in a linear sequence, starting with attention and moving clockwise through the prescribed sequence. The last three events (provide feedback, assess performance, and enhance retention/transfer) are not included because their use and implementation in the audio podcasts were too low a frequency to conduct z-score tests. The left diagram also shows that practice was often followed with guidance as well as an iterative process between guidance and practice. In contrast, the right diagram shows that high-rated podcasts exhibit four of the six patterns in instructional event sequences found in the low-rated podcasts (Attention→Goal, Recall→Material, Material→Guidance, and Guidance→Practice). As a result, both state diagrams provide preliminary and partial evidence to support the event sequences prescribed in Gagne’s model. A Chi-square test revealed no significance difference in the relative frequency of events (Table 1) between groups,  $\chi^2 (8, n = 266) = 6.52, p < .589$ , showing that between low and high-rated audio podcasts, there were no significant differences in the relative frequencies of the instructional events, only differences in the sequencing of the instructional events.



**Fig. 1** Transitional state diagrams of the first six events in low vs. high rated audio podcasts. Note: Thickness of arrow conveys strength of transitional probability; dark black arrows identify probabilities that are significantly greater than expected based on z-score tests ( $p < .01$ ); first and second numerical value displayed in each node identifies the number

of times the given event was observed in the podcasts and the number of events that followed the given event, respectively; the size of the glow emanating from each node conveys the number of times the action was performed

**Table 1** Frequency of instructional events observed in low- and high-rated audio podcasts

Event	Low-Rated		High-Rated	
	%	<i>n</i>	%	<i>n</i>
Attention	.16	15	.18	32
Objective	.18	16	.16	28
Recall	.13	12	.09	15
Content	.22	20	.19	34
Guidance	.15	14	.11	20
Practice	.09	8	.11	20
Feedback	.02	2	.06	11
Transfer	.01	1	.01	2
Perform	.03	3	.07	13
Total		91		175

However, the state diagram on the right reveals that high-rated podcasts were much more likely than low-rated podcasts to skip recall to jump directly to content presentation after presenting goals. Furthermore, content presentation in the high-rated podcasts was followed by practice (rather than guidance) at higher than expected frequency. These findings suggest to an extent that learners prefer audio podcast that go straight to the instructional content and skip instructional events that are supplemental and/or deemed by learners to be optional or unnecessary (e.g., recall; guidance; and guidance→recall sequence). One plausible explanation for these findings is that learners may prefer more streamlined content-focused audio podcasts because of their preference to regulate their own learning and make more efficient use of time. For example, Sinha et al. (2014) analyzed click stream data from more than 700,000 video viewing sessions within a MOOC course and found that the students that often skipped and were least likely to slow down videos were the students that were least likely to watch the video from start to end. Consequently, students that often skipped, fast forwarded, and varied the play rate through different portions of a video spent less time viewing the videos. Another plausible explanation for these findings is that the online learners in this study used audio podcasts to support just-in-time learning to help them perform an immediate specific task (e.g., a personal project or a specific class assignment where relevance has already been established). If this is generally the case, just-in-time learners do not need to recall past experiences to make learning more relevant and meaningful given that they already have a specific task they want to complete going into an audio podcast presentation. Furthermore, just-in-time learners do not necessarily need or do not believe they need recall and guidance to acquire long-term retention of the content because they are: 1) focused on immediately applying and are already in the process of practicing the instructional content to complete a

personal task; and 2) aware that the podcasts (at least in this study) can be accessed at any time in the future should the need arise.

The state diagrams for the low-rated audio podcasts also show that the transition from guidance to practice and the transition reversing back from practice to guidance occurred at frequencies that were higher than expected. Although the reason as to why this iterative process was associated with low-rated podcasts is not evident or clear, this finding might be an indication that learners did not respond favorably to the use of heavy iterative learning processes. Another notable difference is that the low-rated podcasts exhibited a larger number of sporadic events sequences than the high-rated audio podcasts – event sequences that stray a far from Gagne’s prescribed event sequence (e.g., goal← → guidance, recall← → practice, guidance→attention). This finding suggests that the structural organization of the low-rated audio podcast on average may have been inferior to the structural organization of the high-rated podcasts, and that poor structural organization (and any learner confusion resulting from poor organization) can decrease learner satisfaction.

As for the instructional implications, these findings suggest that audio/video instruction should be designed according to whether target learners are or are not using the instruction to support just-in-time learning (to complete a personal task or an in-class assignment) and whether the instructional audio/videos are or are not publically accessible on the web for future reference. When the large majority of the target audience are using the audio/video podcasts to support just-in-time learning, audio/video podcasts should be streamlined and more content focused by skipping recall of prior experiences and by skipping and/or reducing the amount of instructional guidance following the presentation of instructional content. Rather than skipping these two instructional events, however, one alternative is to provide audio/videos with a menu interface to give learners direct access to portions of the audio/videos that serve their individual or immediate needs. Given that the average time to listen to words takes typically twice the amount of time to read words, a menu interface can also include access to text-based versions of each audio/video segment to enable learners to read or skim the content to further increase learning efficiency. On the other hand, when access to the audio/videos are restricted once learners complete a course, audio/video podcasts should include recall of past experiences and instructional guidance within the audio/videos (or in text accompanying the audio/videos) to help improve long-term memory and recall.

In conclusion, this study provides preliminary (but not conclusive) evidence to show the extent to which Gagne’s instructional model and prescribed instructional event sequence are implemented in instructional audio podcasts. More importantly, the findings in this study suggest that event sequences should be modified to accommodate different instructional contexts in

order to increase learner satisfaction and efficiency. Furthermore, this study demonstrates how sequential analysis can be used to conduct further research to identify patterns in event sequences and their association with learner satisfaction, and more importantly, learner achievement and performance. However, no causal relationship between the event sequences and users' podcast ratings can be determined from the findings reported in this study. Nevertheless, the findings provide insights on which event sequences can be varied and tested in future studies using larger sample sizes while controlling for quality in instructional content (across a large number of podcasts covering the same topic), quality of delivery (other than sequencing), with versus without references to external/supplemental resources, instructional context (self-directed learning, classroom instruction), type of medium (audio, video, text), and nature of instructional content (part- vs. whole task complexity, type of learning outcomes) and selecting podcasts from sources (other than iTunes) that provide direct access to user comments posted within the podcast hosting site and/or social media/blog sites. Using the method and approach illustrated in this study, the most effective event sequences can be identified by tracing the pathways students take when using a menu to navigate through audio/video/text materials, and determining the common event sequences exhibited by students that achieve higher versus lower levels of learning and performance. To conduct systematic controlled studies on the impact of specific event sequences (and to garner sufficient sample size to test the impact of each event sequence on student learning), event sequences can be systematically manipulated and

tested on a large scale basis by manipulating and delivering audio/videos in MOOC environments.

## Compliance with Ethical Standards

**Conflict of Interest** The author declares that there are no conflicts of interest.

**Ethical Approval** This article does not contain any studies with human participants performed by any of the authors.

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## References

- Bakeman, R., & Gottman, J. (1997). *Observing interaction: An introduction to sequential analysis*. Cambridge, UK: Cambridge University Press.
- Gagné, R. (1985). *The Conditions of Learning and the Theory of Instruction*, (4th ed.), New York: Holt, Rinehart, and Winston.
- Jeong, A. (2018). Discussion Analysis Tool. Retrieved on December 18, 2018 at <http://myweb.fsu.edu/ajeong/dat>.
- Martin, F., & Klein, J. (2008). Effects of objectives, practice, and review in multimedia instruction. *Journal of Educational Multimedia and Hypermedia*, 17(2), 171–189.
- Sinha, T., Jermann, P., Li, N., & Dillenbourg, P. (2014). Your click decides your fate: Inferring information processing and attrition behavior from MOOC video clickstream interactions. arXiv preprint arXiv:1407.7131. Last retrieved on June 18, 2018 at <https://arxiv.org/pdf/1407.7131>