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Integrating technology in Ayurveda Education: A pilot comparative study on text-based and audio-assisted learning of Ashtanga Hridaya Kalpasiddhi sthana among BAMS students

[*1]Braivin Camly R and [2]Akshar Ashok Kulkarni

[1,2]Department of Samhita Siddhanta, Parul Institute of Ayurveda, Parul University, Waghodia, Vadodara - 391760 (India)
Corresponding author: [*]Dr. Braivin Camly R
Email: drbraivin@gmail.com,
Phone: +919847640653

Abstract

Ayurvedic education traditionally depends on textual study of Samhitas, which requires memorization and understanding of Sanskrit sutras. Modern learners, however, face challenges in comprehending classical texts due to linguistic and conceptual barriers. The integration of technology, such as audio applications providing sutra explanations, offers a potential tool to enhance comprehension and engagement among BAMS students. With this background, a pilot within-subject study was conducted among 25 BAMS students of Govt. Ayurveda College, Thiruvananthapuram, with an aim to evaluate the effectiveness of an audio software application with sutra explanation compared to text-book based learning of Ashtanga Hridaya Kalpasiddhi sthana. This comparative analysis establishes that audio-based learning tools offer substantial pedagogical advantages over conventional textbooks in understanding classical Ayurvedic texts. The implementation of such tools can be scaled up across Ayurvedic institutions to improve learning outcomes, especially in the foundational years of BAMS education.

Key words : Ashtanga Hridaya, Kalpa-siddhisthana, BAMS education, Sutra explanation, Pilot study.

Ayurveda, the ancient Indian system of medicine, is founded upon deep philosophical principles and classical Sanskrit texts known as Samhitas. The study of these texts, such as Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya, forms the corner stone of Ayurvedic education. Shlokas play an important role in Ayurvedic learning, as they convey centuries of knowledge in brief, poetic form. Acharya Charaka, while explaining adhyayana vidhi, emphasised the repeated recitation of sutras, as it aids in strengthening memory and retention

[1]Ph.D. Scholar, [2]Guide and Professor

of knowledge[1]. Traditionally learning occurred through guru-sishya parampara (teacher-student tradition), emphasising oral transmission, memorization of sutras (aphorisms), and interpretative understanding. This method cultivated both knowledge and discipline, ensuring continuity of authentic teaching across generations.

Nowadays, the use of audio applications enhances the traditional method of shloka learning by making it more accessible and engaging through digital tools. Such software is particularly valuable in Ayurvedic education, as it offers recordings and explanations that assist students and practitioners, especially those with limited Sanskrit proficiency, in understanding, retaining, and accurately reciting shlokas. An audio application for Ayurveda shlokas gives learners repeated access to correct recitations, allowing them to practice at their own pace, improve pronunciation, and rely less to a teacher. This kind of practice is especially helpful for students who are learning outside the traditional gurukula system. Audio software application can exert a measurable influence on cognitive, pedagogical, and accessibility outcomes[4]. By combining traditional oral methods with digital tools, an audio-based application can help students learn shlokas more easily, correctly, and efficiently.

Ashtanga Hridaya-the most legitimate and extensive summary of Ayurvedic principles is divided into 6 sthanas and a total of 7471 shlokas. Kalpasiddhi sthana-the fifth sthana of Ashtanga Hridaya, comprises 6 chapters and 305 shlokas dealing with formulations and methods of elimination therapy, management of complications, principles of pharmacy etc[8]. This study aims to evaluate the effectiveness of an audio software application with sutra explanation compared to text-book based learning of Ashtanga Hridaya Kalpasiddhi sthana among the same group of students.

A pilot within-subject study was conducted among 25 BAMS students (Second Professional Junior batch) of Govt. Ayurveda College, Thiruvananthapuram. All participants first studied portions of Ashtanga Hridaya Kalpasiddhi sthana using the traditional Samhita with English translation, followed by learning the same portion through an audio application providing sutra-wise explanations. Data were collected using a validated, structured questionnaire consisting of nine items rated on a 4-point Likert scale (Not able, Somewhat able, Quite able, Very able). The questions were Q1- Are you able to read the shlokas fluently using App/Text?, Q2 - Are you able to recite shlokas fluently using Text/Audio application?, Q3 - Are you able to understand anvaya (prose order) using Text/Audio application?, Q4 - Are you able to understand bahvartha (meaning of the shlokas) using the Text/Audio application? Q5 - Are you able to understand sandhi (joining words) using Text/Audio application?, Q6 - Are you able to understand samasa (compound words) using Text/Audio application?, Q7 - Are you able to understand tantrayukti (methodological tool) using Text/Audio application?, Q8 - Would you think that the description provided in the Text/Audio application is enough for learning shlokas?, Q9- How would you rate the effectiveness of Text/Audio application in improving your understanding of shlokas?

Responses obtained following text-based learning and audio application-based

learning were compared. As the study followed a within-subject design in which the same participants experienced both learning methods, paired comparisons were appropriate. Descriptive statistics were used to summarize the responses. Inferential analysis was performed using the Wilcoxon Signed-Rank Test for paired ordinal data. A p-value of less than 0.05 was considered statistically significant.

Outcome :

Table 1. Distribution of student responses following Textbook-based learning and Audio Applicaton-based learning across nine learning domains (n = 25)

Responses of students text vs app		Very able		Quite able		Somewhat able		Not able		Total	
		Frequency	percentage	frequency	percentage	frequency	percentage	frequency	percentage	frequency	Percentage
Q1	TEXT BOOK	5	20%	13	52%	7	28%	0	0%	25	100%
	AUDIO APP	12	48%	11	44%	2	8%	0	0%	25	100%
Q2	TEXT BOOK	1	4%	8	32%	15	60%	1	4%	25	100%
	AUDIO APP	11	44%	9	36%	5	20%	0	0%	25	100%
Q3	TEXT BOOK	1	4%	2	8%	18	72%	4	16%	25	100%
	AUDIO APP	8	32%	14	56%	2	8%	1	4%	25	100%
Q4	TEXT BOOK	1	4%	5	20%	13	52%	6	24%	25	100%
	AUDIO APP	10	40%	12	48%	3	12%	0	0%	25	100%
Q5	TEXT BOOK	2	8%	7	28%	15	60%	1	4%	25	100%
	AUDIO APP	15	60%	8	32%	2	8%	0	0%	25	100%
Q6	TEXT BOOK	1	4%	2	8%	17	68%	5	20%	25	100%
	AUDIO APP	11	44%	9	36%	4	16%	1	4%	25	100%
Q7	TEXT BOOK	1	4%	1	4%	11	44%	12	48%	25	100%
	AUDIO APP	10	40%	10	40%	4	16%	1	4%	25	100%
Q8	TEXT BOOK	2	8%	11	44%	10	40%	2	8%	25	100%
	AUDIO APP	13	52%	9	36%	3	12%	0	0%	25	100%
Q9	TEXT BOOK	2	8%	12	48%	11	44%	0	0%	25	100%
	AUDIO APP	17	68%	8	32%	0	0%	0	0%	25	100%

Table-1 demonstrates a clear shift toward higher response categories following the use of the audio application. For Questions 1–9, the proportion of students rating themselves as "Very able" increased substantially after exposure to the audio application. For example, in Question 9, the proportion of students selecting the highest rating increased from 8% in the textbook group to 68% in the audio application group. Similarly, for Questions 2, 4, 5, 6, and 7, the percentage of students reporting "Very able" increased by more than 30 percentage points. Concurrently, the proportions of "Somewhat able" and "Not able" responses decreased across nearly all domains. These findings suggest that the audio application improved students' perceived competence in understanding and interpreting the contents of Ashtanga Hridaya Kalpasiddhi Sthana.

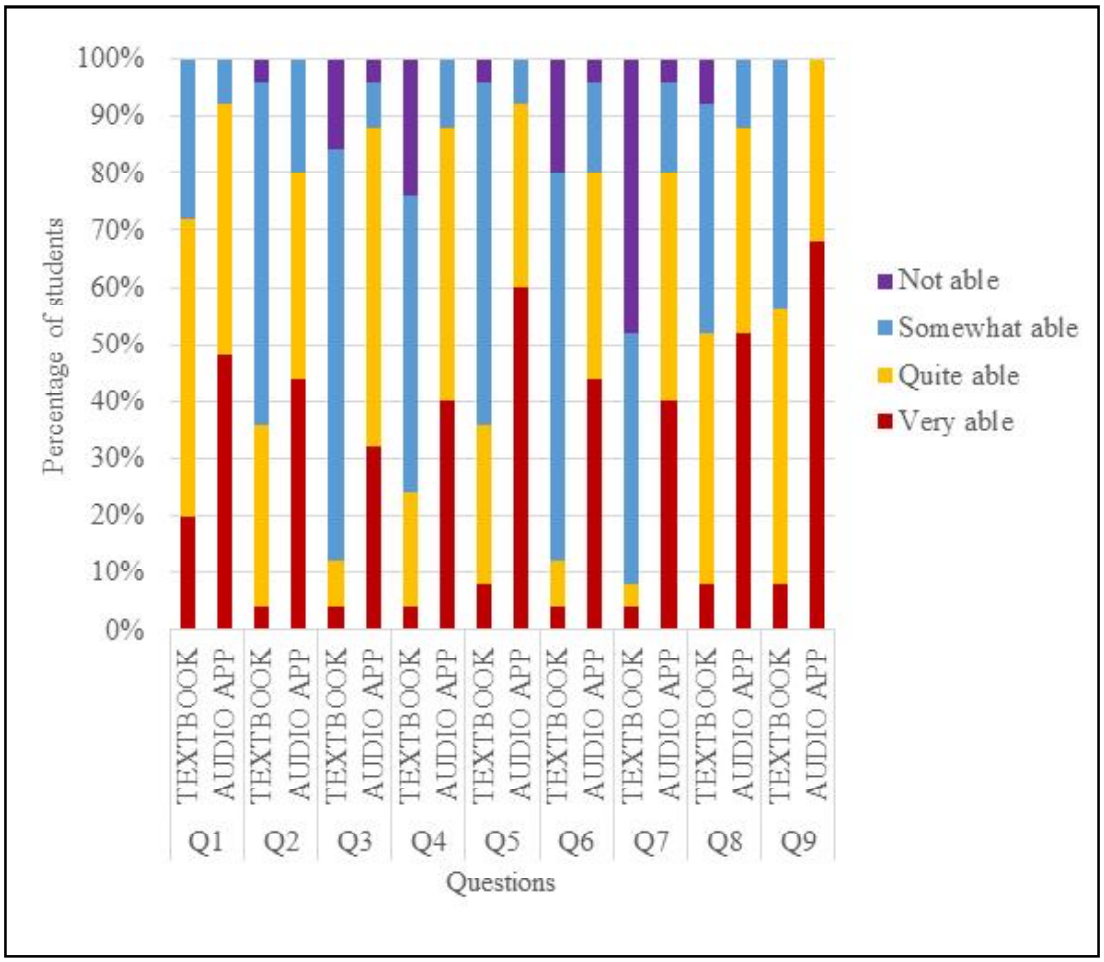

Figure 1. Percentage distribution of student responses for Textbook-based learning and Audio Application-based learning across nine questionnaire items

Figure 1 (Stacked bar chart) illustrates the response distribution for all nine questionnaire items under both learning methods. The same options for question 1 to 8. For question 9 the options are "Not effective=1, Slightly effective=2, Moderately effective=3, Very effective=4".

Across most domains, the audio application produced a visible shift toward the higher response categories ("Quite able" and "Very able"), whereas textbook-based learning generated larger proportions of "Somewhat able" and "Not able" responses. The trend was consistent across all questionnaire items, indicating a broadly positive impact of audio-assisted learning on students' confidence and comprehension. The most pronounced differences were observed in Questions 5, 7, and 9, where the proportion of students selecting the highest response category increased markedly following use of the audio application.

Table-2. Shapiro–Wilk test for normality of student response scores following Textbook-based learning and Audio Application-based learning

Shapiro-Wilk test for normality						
Questions	Textbook			Audio App		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Q1	0.808	25	0.000	0.756	25	0.000
Q2	0.78	25	0.000	0.785	25	0.000
Q3	0.713	25	0.000	0.786	25	0.000
Q4	0.847	25	0.002	0.785	25	0.000
Q5	0.785	25	0.000	0.706	25	0.000
Q6	0.743	25	0.000	0.812	25	0.000
Q7	0.74	25	0.000	0.824	25	0.001
Q8	0.861	25	0.003	0.752	25	0.000
Q9	0.763	25	0.000	0.59	25	0.000

As shown in Table-2, the Shapiro–Wilk test revealed significant deviations from normality for all questionnaire items under both textbook and audio application conditions ($p < 0.05$). This indicates that the response distributions were non-normal and confirms the appropriateness of using non-parametric statistical methods. Consequently, the Wilcoxon Signed-Rank Test was selected for paired comparisons because it does not require the assumption of normal distribution and is suitable for ordinal Likert-scale data.

Qualitative responses were coded on a 4 point ordinal scale and analyzed with Wilcoxon signed rank test. (Scores 1-4, not able = 1, somewhat able = 2, quite able = 3, very able=4 and not effective=1, slightly effective=2, moderately effective =3, very effective =4)

Table-3. Comparison of Textbook-based learning and Audio Application-based learning using Wilcoxon Signed-Rank Test

Wilcoxon Signed Rank Test								
Textbook Vs Audioapp		Median	SD	Q1	Q3	Iqr	Z	P Value
Q1	Textbook	3	0.702	2	3	1	-2.546	0.011
	Audio App	3	0.646	3	4	1		
Q2	Textbook	2	0.646	2	2	0	-4.01	0.000
	Audio App	3	0.746	3	4	1		
Q3	Textbook	2	0.707	2	3	1	-3.798	0.000
	Audio App	4	0.653	3	4	1		
Q4	Textbook	2	0.757	1	2	1	-4.075	0.000
	Audio App	3	0.851	3	4	1		
Q5	Textbook	3	0.638	2	3	1	-3.96	0.000
	Audio App	4	0.476	3	4	1		
Q6	Textbook	2	0.638	2	3	1	-3.394	0.001
	Audio App	3	0.779	3	4	1		
Q7	Textbook	2	0.79	1.5	2.5	1	-3.991	0.000
	Audio App	3	0.678	3	4	1		
Q8	Textbook	2	0.676	2	2	0	-3.808	0.000
	Audio App	3	0.866	3	4	1		
Q9	Textbook	3	0.77	2	3	1	-3.42	0.001
	Audio App	4	0.707	3	4	1		

Table-3 presents the results of the Wilcoxon Signed-Rank Test comparing student ratings following textbook-based learning and audio application-based learning. Statistically significant differences were observed for all nine questionnaire items ($p \leq 0.011$), indicating that students consistently rated the audio application more favourably than the textbook method.

Median scores for the audio application ranged from 3 to 4, whereas textbook scores ranged from 2 to 3. Particularly notable improvements were observed in Questions 3, 4, 5, and 7, where median ratings increased from 2 in the textbook condition to 3 or 4 in the audio application condition. The consistently negative Z-values indicate that the direction of change favoured the audio application. The relatively narrow interquartile ranges observed for the audio application suggest greater agreement among students regarding its effectiveness. Collectively, these findings demonstrate that the audio application significantly enhanced students' perceived understanding, confidence, and learning effectiveness compared with conventional textbook based learning.

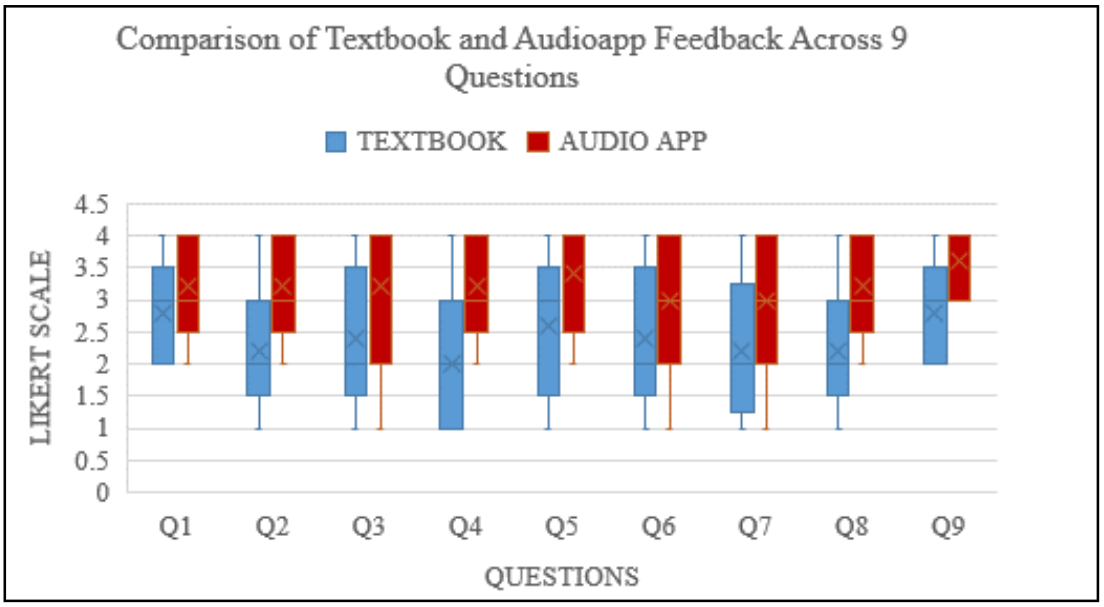

Figure 2. Median scores of student feedback for Textbook-based learning and Audio App-based learning across nine questionnaire items

Figure 2 illustrates the comparison of student feedback for Textbook and Audio App across nine items rated on a 4-point Likert scale. For all nine questions, median scores for Audio App were higher than those for Textbook. While Textbook responses clustered between 2 and 3, Audio App responses clustered between 3 and 4, indicating overall more positive perceptions toward Audio App.

The present pilot study evaluated the effectiveness of an audio software application with sutra-wise explanations compared with conventional textbook-based learning for understanding Ashtanga Hridaya Kalpasiddhi Sthana among BAMS students. The findings indicate that students consistently reported higher levels of confidence and understanding when learning through the audio application than through the traditional text-based method.

Across all questionnaire domains, including reading fluency, shloka recitation, understanding of anvaya, bhavartha, sandhi, samasa, and tantrayukti, the audio application demonstrated superior performance. A greater proportion of students rated themselves as "Very able" or "Quite able" after using the application compared with the textbook method. These findings suggest that audio-assisted learning may facilitate better comprehension of classical Ayurvedic texts by combining auditory and explanatory inputs with conventional textual information[5,8].

One of the major challenges in Ayurvedic education is the linguistic complexity of Sanskrit texts. Students often find it difficult to understand grammatical constructs such as sandhi, samasa, and anvaya, which are essential for interpreting classical literature. The audio

application used in this study provided structured explanations alongside recitation, thereby reducing the cognitive burden associated with independent textual interpretation. Similar findings have been reported in digital learning research, where multimedia approaches combining audio and verbal explanations have been shown to improve comprehension and learner engagement[2,3,7].

The favourable response towards the audio application may also be explained by Mayer's Cognitive Theory of Multimedia Learning, which proposes that learner's process information more effectively when content is presented through multiple sensory channels.[5] Audio explanations can support auditory processing while reinforcing textual information, thereby improving understanding and retention. Furthermore, repeated access to recorded explanations enables self-paced learning, which is particularly beneficial for students with varying levels of Sanskrit proficiency[6].

The results also demonstrated a significantly higher rating for the overall effectiveness of the audio application in improving understanding of shlokas. Most participants considered the application either very effective or moderately effective, whereas responses for the textbook method were predominantly distributed between moderately effective and slightly effective categories. This finding highlights the potential of technology-assisted learning as a valuable adjunct to traditional pedagogical approaches in Ayurveda.

Despite these encouraging findings, several limitations should be considered. First, the study involved a relatively small sample size and was conducted in a single institution, which limits generalizability. Second, the study employed a within-subject design in which all participants were exposed to the textbook method before the audio application. Therefore, an order effect cannot be excluded. Third, the outcomes were based on self-reported perceptions rather than objective assessments of knowledge acquisition or retention. Future studies should incorporate larger multicentric samples, objective academic performance measures, and randomized crossover designs to strengthen the evidence base.

Overall, the findings suggest that audio-assisted learning can enhance students' understanding and confidence in studying classical Ayurvedic texts. Integrating such technology with traditional teaching methods may contribute to improved learning outcomes and greater accessibility of Ayurvedic education for contemporary learners.

Ethical Consideration :

Institutional approval was obtained. Written informed consent was taken from all participants. Confidentiality and voluntary participation were ensured.

The audio app method proved to be a more effective and engaging tool for learning Ashtanga Hridaya compared to the traditional text-based approach. Students not only perceived themselves as more capable but also showed statistically significant improvement in comprehension and confidence levels. Hence, integrating audio technology in Ayurveda education can serve as a valuable adjunct to traditional pedagogy, promoting better understanding and retention of ancient texts.

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