

COMPARISON BETWEEN SYNCHRONOUS AND ASYNCHRONOUS INSTRUCTIONAL DELIVERY METHOD OF TRAINING PROGRAMME ON IN-SERVICE PHYSICAL EDUCATORS' KNOWLEDGE

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ABSTRACT

The purpose of the study was to compare the influences of a training programme's instructional delivery method (synchronous and asynchronous) on Greek in-service physical educators' cognitive understanding on student assessment. Forty nine participants were randomly divided into synchronous, asynchronous, and control group. The experimental groups participated in the same training programme with different online instructional method. The control group received no intervention. A 17-item questionnaire was completed before and after programme implementation by the entire sample. A two-way analysis of variance with repeated measures on the last factor was used for data analysis. The methods x measures interaction effect were significant. Both experimental groups, unlike the control, presented a similar significant increase in their understanding. Conclusively, synchronous and asynchronous instructional approaches of a training programme enhance equally Greek physical educators' cognitive understanding.

Keywords: Synchronous e-learning, asynchronous e-learning, teacher training, physical education, elementary student assessment.

INTRODUCTION

The importance of continuous recording of student progress is noted as a key component of effective teaching (Good & Brophy, 1986). The manuals of assessment in physical education and the curriculum theories emphasize clearly the need for systematic and objective student assessment (Safrit & Wood, 1995). According to Schiemer (1999), a carefully designed programme of students' assessment is an important tool for the teachers' job, because the results provide information about student achievement in learning objects and criteria of instruction's adoption. Simultaneously, constructivism (Vygotsky, 1978), critical thinking (Bruner, 1997) and holistic approach to knowledge (Wineburg & Grossman, 2000) influenced the theoretical orientation of the curricula and school practice and led to alternative teaching and assessment approaches and techniques (Melograno, 2006). Beyond this, teachers' preparation in student assessment during their undergraduate studies is poor (Mertler, 2003; Schafer, 1993; Stiggins, 1999) and according to Mertler (2003) experiences of in-service teachers improve, but not sufficiently, their knowledge and practices in that area. As a result, teachers' professional development programmes on student assessment are necessary, given their effectiveness on participants' knowledge and attitudes (Mertler, 2009; Rockman, Borse, Farr, Weissman, & Shapiro 2004; Sato, Wei, & Darling-Hammond, 2008; Westfall, 2007).

At the same time, the demands of work and family life for teachers underline the need for professional development activities that can be delivered anytime, anywhere (Vrasidas & Glass, 2007). Technology provides useful tools for accessing various means of distance professional education, synchronous and asynchronous, and makes it possible for teachers to form virtual learning communities with their colleagues in schools throughout their country and around the world (Harwell, 2003). It has the potential to fill the gaps between time and location constraints and to help flexible education and lifelong learning (Chen, Kinshuk, Ko, & Lin, 2004). Synchronous learning employs videoconference and other multimedia techniques to allow instructor and students to interact with each other at the same time, even if they are not at the same place (Chen et al., 2004). The adoption of synchronous online instruction mode in professional development programmes, which in-service teachers as participants found its flexible design to be useful (Marrero, Woodruff, Schuster, & Riccio, 2010), provides excellent trainee teachers' learning outcomes and satisfaction (Chen et al., 2004). Also it has the ability to give teachers the kind of pedagogical, technological, or psychological support they need (Wang, Chen, & Levy, 2010). Concerning asynchronous learning, it is facilitated by media which support work relation among learners and with the instructor, even when they cannot be on-line at the same time, allowing teachers to combine education with work, family and other commitments.

Even though participants in asynchronous learning environments need more time to refine their contributions, their contributions are generally considered more thoughtful compared to synchronous learning (Hrastinski, 2008).

Although a great deal of research has addressed the feasibility of online education and the use of technology within formal educational settings (e.g., Rovai & Jordan, 2004; Wang & Reeves, 2007) little research has been conducted within the professional development environment, which involves training relative to the current occupation of the adults, as opposed to academic courses offered by colleges and universities (Donavant, 2009).

Comparative studies of professional development programmes explored mostly the effectiveness of distance learning modes compared to traditional face to face (e.g., Harlen & Doubler, 2004; Hartshorne, 2005; Johnson, Aragon, Shikes, & Rivas, 2000) and less among distance learning modes (e.g., Annetta & Shymansky, 2006) in participants' opinions, attitudes and knowledge gains.

In Greece, according to Ifanti and Fotopoulou (2011), a great number of educators regard professional development as a multidimensional and complicated process and underline the need for their involvement in specific education and training programmes.

The formal professional development in Greece is accomplished traditionally face to face in forms of introductory and periodic seminars by Regional Training Centers, the Ministry of Education, and school counsellors. Problems such as non in proper time informing of educators in new learning material and instructional process, as well as attending problems due to participants' family and professional obligations have been presented (Gotzaridis, Antoniou, & Vernadakis, 2010).

The same time, Greek educators and specifically in-service physical educators believe in distance professional development programmes' success and they express interest in participating in them (Antoniou & Siskos, 2007).

Distance professional development programmes for in-service teachers have been conducted informally in Greece through University programmes (e.g., Hlapanis & Dimitrakopoulou, 2007; Maheridou, Antoniou, Kourtessis, & Avgerinos, 2011; Makrakis, 2001) and by counsellors of school districts (Gotzaridis et al., 2010). In these programmes mostly educators' attitudes about distance education use in professional development were assessed whereas there is no evidence about their knowledge gains, as a result from their attendance. But the impact of professional development on teachers' knowledge and practice is considered as a factor of the effectiveness of professional development (Avalos, 2011). Also, the recognition of any delivery method as appropriate for providing professional training depends among others on the data indicating that learning actually occurred (Donavant, 2009). Therefore, given the need for flexible professional development of Greek educators and the importance of their knowledge of student assessment, the purpose of the present study was to compare the effectiveness of two online instructional approaches (synchronous and asynchronous) to deliver a professional development programme on in-service physical educators' knowledge of student assessment.

RESEARCH DESIGN

In the present study, the participants were randomly assigned to three groups, two experimental and one control. The two experimental groups attended a five-week online training programme with different instructional methods, the same content, the same group work and activities, and the same instructor who had a large experience in both teaching methods.

For the first group the programme was provided with a synchronous online method (synchronous group, SG) and for the second group with an asynchronous online method (asynchronous group, AG).

The control group (CG) received no training programme. All participants were holding only a bachelor degree in Physical Education. Also none of them had used before platforms of synchronous or asynchronous e-learning. The study followed a pretest-posttest ("before" and "after") experimental design, taking before and after measurements of each group, in order to explore the effects of the instructional methods on participants' knowledge achievement, as measured by a tested knowledge questionnaire. The following questions were posed as framework of the study:

- Is there different rating change in knowledge of the experimental and control groups of the study between the two measures?
- Is there a significant difference in knowledge among experimental and control groups in post-test measures?
- Is there a significant difference in knowledge between pre- and post measure in each group of the study?

METHOD

Participants

Forty-nine in-service elementary physical educators with teaching experience from 5 to 20 years ($M=12.2$ years, $SD=4.7$), who teach in different schools of Northern and Central Greece, participated voluntarily, after being informed about the purpose of the study. The participants were assigned randomly to three groups, synchronous, asynchronous and control. The first group ($N=15$) initially consisted of 16 participants of which one eventually abandoned due to professional workload. In the second group ($N=14$) 17 participants were initially involved, but three of them left the programme because of health problems in a family member ($N=1$) or professional commitments ($N=2$). The control group was formed by 16 participants without dropouts.

Software instruments

Synchronous

Centra software (Saba, 2008) was used by participants of SG as instructional delivery method of the training programme. Centra software is an online platform which ensures the implementation of synchronous distance education with the possibility of presenting educational material and interactive real-time visual and audio communication between instructor and participants who are in different geographical locations. Participants access to a virtual room, in pre-arranged time, using their personal codes. In the environment of the virtual room they can use a variety of interactive tools like raising hands, agree and disagree with others' comments and opinions, applause after colleagues' comments and inform others when temporally "step out" of the room. Also Centra software allows participants to view the educational material of the session (e.g. PowerPoint presentation) in "Agenda" tool, to use the whiteboard tools in order to intervene to the material and to save files that instructor upload on the main screen of the virtual room. Furthermore, the software allows the instructor to send the participants into separate virtual breakout rooms for group discussion, which facilitates the peer to peer exchanging of experiences and cooperative learning. Finally, the software gives instructor the possibility to record and publish part or the entire session after its completion, to be repeated as many times as desired by the participants.

Asynchronous

The Open e-class software was used by participants of AG as instructional delivery method of the programme. The Open eClass platform is an integrated Course Management System, used to store and present educational materials. It is offered by the Greek Academic Network (GUnet) to support asynchronous e-learning services. Basic platform characteristics are distinct user roles and course categories, easy course creation and use, and structured course presentation (GUnet Asynchronous eLearning Group, 2008). The instructor creates and manipulates an e-Course. Participants access the Open e-class platform and then the e-Course, using their individual user name and password. After their logging, the participants enter into their personal portfolio and then to the particular e-Course. On the e-Course home screen, there was basic information, like the course title, the name of the responsible teacher and the instructor's email hyperlink which allowed participants to communicate with the course teacher via email. Additionally, on the left side of the screen, there was a menu with all the active eLearning tools provided for the e-Course by the instructor (e.g., Documents, Announcements, Groups, Course description, Agents etc).

Content of the Training Programme

The major goal of the training programme was to enhance participants' knowledge of student assessment. The programme consisted of five sessions regarding Physical Education' domains, with the following topics:

- student evaluation and grading methods in physical education,
- movement skills enhancement and assessment,
- cognitive concepts enhancement and assessment,
- social skills and values enhancement and assessment,
- health-related fitness development and assessment.

The programme developers embraced cognitive and social-cognitive learning theories. They aimed to provide participants with experiences of cooperative learning and social interaction, and to promote reflection on the process of learning through practice in school environment. The teaching process was designed and organized according to the principles of distance teaching and learning (American Distance Education Consortium [ADEC], 2003). The educational material;

- was constructed according to pedagogical requirements (e.g., reference on section's targets and connection with previous sections, simple instructions to navigate in the learning environment, self-assessment activities etc.) (Lionarakis, 2001),
- was in line with the educational purposes which rule distance education (e.g., use of pre-existing knowledge, application of new knowledge in the classroom, enabling critical thinking etc) (Lionarakis, 2001), and adult learning (e.g., provided real-life examples, avoided information overload, encouraged expression of thoughts, activities implementation and cooperation) (Rogers, 1999), and
- was based on teaching principles of behaviorist, cognitivist, constructivist learning theories (e.g., feedback provision, unlimited repetition of content, transfer of knowledge through questions and clarifications, examples and practices of realistic applications, navigation through a "menu" and "buttons" and use of different media such as video and voice files) and on cooperative learning as well (Jonassen, 1991).

Instrumentation

A knowledge questionnaire (Emmanouilidou, Derri, Aggelousis, & Vassiliadou, 2012) was used to provide data on physical educators' knowledge of student assessment. The questionnaire concerned concepts, methods, tools and types of student assessment in elementary physical education.

It consisted of 17 multiple choice questions with five possible responses each, one correct, three wrong and an "I do not know". It includes items such as: "Tools which are used when alternative assessment is applied are ...

- checklists and rubrics
- standardized fitness and skill tests
- multiple-choice tests of sports' history and regulations
- traditional games and sequence of skills
- "I do not know" or

"Cognitive elements in which students should be evaluated are

- motor skill cues, training principles, cooperation
- games strategies, sports regulations, cooperation
- game strategies, nutrition principles, skill performance
- game rules, cooperation principles, fitness concepts
- "I do not know".

The score ranged from 0 to 17 points (each answer was graded with one point if it was correct and zero point if it was wrong or "I do not know"). Apart from content and face validity, the questionnaire has acceptable internal validity according an item analysis which showed:

- the index of difficulty between .24 and .72,
- the index of discrimination from .23 to .60, and
- the functioning of all possible responses to a questionnaire item.

The internal consistency of the questionnaire was quantified with an acceptable for small knowledge questionnaire value of Cronbach's alpha ($\alpha=.67$) and an acceptable corrected point biserial correlations for all items. Regarding test-retest reliability, the questionnaire has a strong intra-class correlation ($R=.911, p<.05$).

Procedure

Initially, all participants were pre-tested, completing the knowledge questionnaire via paper and pencil method within half an hour in the presence of a researcher.

Before the intervention started, the experimental groups received via e-mails their user names, passwords and guidelines for online platforms access.

Also, SG was received a 60-minute introductory session for uploading Centra software and checking audio and microphone parameters. Afterwards, the experimental groups attended the 5-week training programme, according to each instructional method:

The SG's participants were watching and participating in a two-hour session, once a week, out of their class time at school in Centra software. In each session:

- The instructor lectured on PowerPoint presentation slides, the educational material, in the environment of Centra platform. The lecture included initially a short repetition and link to the previous section and then reference to the objectives and expected results of the current session. The slides integrated text, drawings, pictures and small videos, references to literature for further information and hyperlinks to websites. The participants and the instructor communicated through audio, chat and a written text.
- To assess participants' understanding of the content during the instructional process, small tests were provided either by the instructor in the form of oral questions or by the option "survey" of the platform in the form of multiple choice questions. Feedback was given orally by the instructor.
- The option "survey" of the platform was also used for anonymous collecting of participants' views on a particular lecture's theme. Then, a discussion began with the instructor asking willing participants with opposing views to explain their choices of answer, stimulating their interaction in the virtual environment.
- The last thirty minutes of the session, participants were split into small groups in breakout rooms to conduct cooperative assignments (e.g., *"design an activity using an authentic or alternative assessment technique"*); the results were then announced to all participants in the central room of the platform by the leader of each subgroup.
- At the end of the session there was a summary by the instructor of what had been taught, announced relevant literature suggestions for further information, and assigned drafting individual work which was related to the application of each lecture's content in the classroom environment. Voluntarily, the results and experience of assigned work were exchanged among participants at the beginning of the next session. Furthermore, each session was recorded and was available in the platform, after its completion,

For the AG, the instructor, who was the same with SG, created and manipulated an e-Course named "Training programme in student assessment for in-service physical educators". Once a week the next activities took place:

- The instructor uploaded the educational material which included an interactive PowerPoint presentation on the platform's learning tool "Documents". The interactivity with the material enabled participants to control the presentation order, its repetition and time on learning. Right and left arrows as next and previous buttons and menu button were provided at any time of the presentation. Certain words or phrases of the texts, which were shown underlined and in blue colour to indicate that they were clickable, provided further explanations, examples, sound files and relevant literature suggestions for further information. Also, participants received feedback from answering multiple choice or right/wrong questions that were included at each PowerPoint presentation for self-assessment. For all of the available choices, users were given feedback about their answers, correct or wrong by the material. In case of wrong answers, they were provided hot texts with information about the error and its cause.

- The instructor hung a weekly discussion topic related to the current presentation content on the learning tool “Forums” and participants posted and exchanged opinions and ideas on it. On the same tool participants posted technical and content-oriented questions and received answers from other participants or the instructor, and submitted concerns to interact with their colleagues and the instructor.
- Also, participants were separated by the instructor into three to four members working teams in the “User Groups” tool, and shared the same conversation hall as well as the file and assignment submission area. In this case, they were required to complete cooperatively the group assignment of the week, which was common for all teams. Then, the completed assignments of the groups were uploaded to the “Documents” tool in order to be viewed by all participants and commented on the “Forum” by the participants and the instructor.
- As in SG, participants in the AG were suggested to implement assessment ideas included in every lecture’s content in their school environment and to upload their experience on the “Forum” tool of the platform.

After the completion of the programme, participants of the three groups were post-tested via the same instrument. The procedure for the completion of the questionnaire was the same with that in the pre-test.

RESULTS

Means and standard deviations of knowledge questionnaire scores of the three groups and of the total sample in both measures are shown in Table: 1.

Table: 1
Means and Standard Deviations of knowledge questionnaire scores

Group	N	Pre test		Post test	
		M	SD	M	SD
Synchronous	15	7.0	2.73	10.67	3.11
Asynchronous	14	6.5	2.31	10.36	2.89
Control	16	6.9	1.98	6.32	2.41
Total	45	6.82	2.28	9.02	3.42

A two-way analysis of variance (ANOVA) with repeated measures on the last factor was conducted to examine effect of instructional Methods (synchronous, asynchronous, none) and Measures (pre-test, post-test) on knowledge questionnaire scores. The model assumptions were evaluated and met. Homogeneity of variance and Sphericity of factors’ scores were verified by Levene’s and Box’s M tests. Test significance was based on a standard alpha level of $p < .05$ and effect sizes on partial η^2 according to Cohen (1988). The Methods x Measures interaction effect was significant ($F(2,42)=12.52, p < .001, \eta^2=.37$) implying a different range of change in knowledge of the experimental and control groups between the two measures (Figure 1). A significant main effect was also noted for the factor Measure ($F(1,42)=29.94, p < .001, \eta^2=.42$) and for the factor Method ($F(2,42)=4.62, p < .05, \eta^2=.18$).

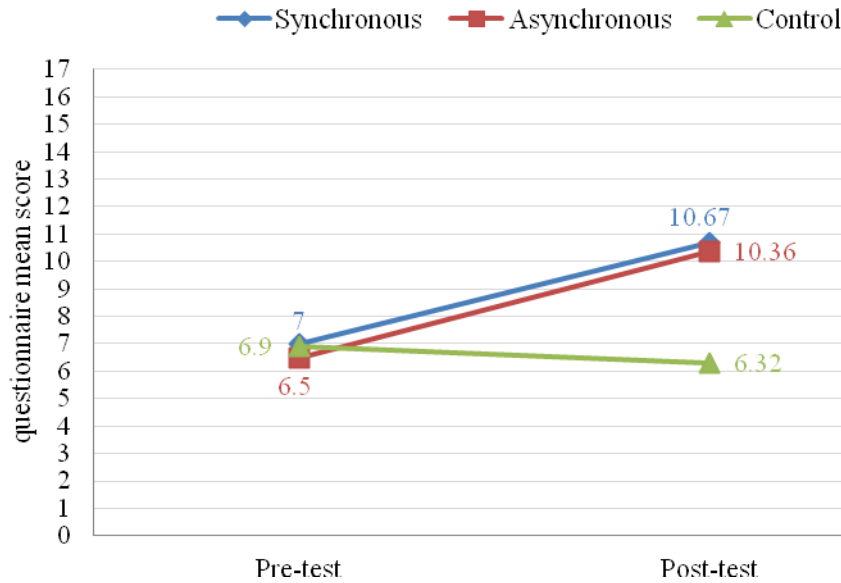


Figure: 1
Experimental and control groups' scores in questionnaire before and after professional development

One-way between groups analyses of variance were applied after the finding of the significant interaction to assess differences among instructional method groups at each measure. Difference among groups in questionnaire scores was not statistically significant at pre-test ($F(2,45)=.67, p>.05$) while a statistically significant difference was found for the three groups at post-test measure ($F(2,42)=11.58, p<.001$). The effect size, calculated using eta square, was large (.36). Post-hoc comparisons using the Tuckey HSD test indicated that the mean score of CG ($M=6.31, SD=2.41$) was significantly lower than the mean score of each of the experimental groups. SG ($M=10.67, SD=3.11$) did not differ significantly from AG ($M=10.36, SD=2.9$).

Lastly, two paired-samples t-tests were conducted to assess differences across time at each instructional method group. There was a statistically significant increase in knowledge questionnaire scores from pre- to post-test for both synchronous, $t(14)=4.75, p<.001$, and asynchronous, $t(13)=4.067, p=.001$, groups. The eta squared statistics (.62 for SG and .56 for AG) indicated a large effect size. Concerning the CG, there was not a statistically difference between the two measures, $t(15)=1.46, p>.05$.

DISCUSSION

The purpose of the present study was to compare changes on three group's (SG, AG, CG) in-service physical educators' knowledge of student assessment.

Based on the results, participants of the groups had different progress in knowledge between the two measures. Specifically, it was indicated that after the implementation of the five week programme, knowledge enhancement of student assessment was occurred for both experimental groups' participants while control group had no change.

Before their participation in the programme, physical educators' knowledge of student assessment was limited since only about the 40% of questionnaire items were answered correctly. Even though they answered correctly items related to student assessment concepts, they were not aware of authentic and alternative assessment methods, techniques and instruments used to assess students in cognitive and affective elements or of the benefits of student involvement in peer and self assessment procedures in physical education. This lack of knowledge may be explained by the fact that participants of the present research, as the majority of Greek physical educators in general, who have been teaching for many years in elementary schools, had received no previous training in student assessment and evaluation issues in their basic tertiary education. The course of student evaluation was included in the curricula of the Greek Departments of Physical Education and Sport Science the last decade. Also, as one of the participants commented, "*... all these years we had no guidelines for student evaluation*", since the Physical Education Curriculum and the Teacher's book from Ministry of National Education and Religious Affairs (1995) that had been existing until 2006, included no relative information and directions for elementary student assessment. However, in the new physical education curriculum and the Teacher' Book (Ministry of National Education and Religious Affairs, 2006), there were for the very first time references to the necessity of students' assessment and to its modern terms like "authentic" and "alternative" assessment, along with guidelines for their implementation. Nevertheless, professional development programmes with such a subject have not been yet implemented officially.

After the implementation of the present programme, the vast majority of experimental participants improved their knowledge since they answered correctly more questions than they did before their enrolment in the programme. The post-test showed that both experimental groups answered correctly an average of 62% of questionnaire items, meaning a percentage of knowledge improvement of 52% and 59% for the synchronous and asynchronous instructional group, respectively. It seems that the contact with new knowledge helped them understand new assessment concepts, and differentiate their views and practices in student assessment. The programme provided participants the stimulus to try making the evaluation a primary issue of their teaching, focusing on learning and not just on grading.

Both experimental groups did have statistically significant increases of their knowledge after programme's implementation, although the increase difference between them was not significant. But the resulting lack of difference in knowledge improvement between the two online instructional methods is important to note. Hrastinski (2008) claims that both a synchronous and an asynchronous environment support concepts of cognitive participation.

On the one hand, in a synchronous environment the presence of instructor makes participants feel more committed and motivated to study the content and get acquainted even though in a simplified way. On the other an asynchronous environment allows more reflective type of participation because participants have more time to reflect due to no time restriction.

In the present study, even though preferable learning style of participants was not taken into account, it seems that both instructional delivery environments helped equally participants to enhance their understanding of programme's content and as a result to improve their knowledge of student assessment.

This present study, the effectiveness of distance education methods and e-learning platforms used in programmes to enhance knowledge of in-service teachers, was verified in a variety of subject matters such as science (Harlen, & Doubler, 2004; Hartshorne, 2005), mathematics (Pryor & Bitter, 2008) and student assessment in varied subject matters (Rockman et al., 2004) when compared to control or face to face methods. Also, in accordance to the present study, there are research findings of no significant difference in success based on on-line learning environment (e.g. Chernish, DeFranco, Lindner, & Dooley, 2005; Kromrey & Purdom, 1995) but with university students as participants. Comparative studies for distance delivery methods with in-service teachers (e.g. Annetta & Shymansky, 2006) concluded that synchronous outperformed asynchronous method in participants' science knowledge enhancement. This finding is contrary to the present results, but it concerns a 5-year professional-development project.

Evaluating the outcomes of the present study limitations that should be noted are:

- The fact of voluntarily participation of the programme's attendants. The mandatory participation of in-service teachers in such a programme could result in deferent outcomes.
- The fact that participants were from schools of Northern and Central Greece. It is possible that a larger sample with physical educators from all over Greek schools would yield in different results.

CONCLUSIONS

Examining the results, this study provides evidence that the integration of online instructional delivery methods into the training environment does result in a significant increase in participants' knowledge of student assessment.

At the same time, this kind of training programmes, synchronous or asynchronous, free in-service teachers from place limitations, allow them to access to numerous content resources and communication tools.

The resulting lack of a significant difference in the increase of knowledge between SG and AG provides evidence to any institution interested in instructional design of a training programme on student assessment with two equally effective methods which meet the educational needs of teachers as adult workers. Given the effectiveness of both online instructional methods, the most appropriate with regard to its financial efficiency (technological equipment cost, ensuring technical staff, training of instructors etc) can be chosen by the persons in charge or by teachers based on what they consider most profitable for themselves.

In the present study, the effectiveness of the teachers' knowledge growth, in terms of their students' achievement, was not measured. Therefore, it would be beneficial to further study whether or not the increase of teachers' knowledge on student assessment influence student achievement in physical education, which is an essential factor of a qualitative professional development programme. Moreover, the programme's effects were not studied over time. For this reason, it would be useful to administer the measures of teachers' knowledge of student assessment at various times, after the completion of the training programme, in an attempt to examine its effects on teachers' learning.

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