

Success of university students in preparing HOTS questions using assignment-based direct instruction



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ABSTRACT

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The purpose of this study is to explore the effectiveness of assignment-based direct instruction in preparing university students to develop questions that test learners' thinking skills. One of the greatest challenges facing universities is preparing potential teachers with the ability to develop questions that test students' higher-order thinking skills (HOTS). Using a quantitative descriptive approach, this study analyses the work of 40 university students who were asked to prepare 20 items, as well as question grids and cards for each item, after having undergone assignment-based direct instruction. Analysis shows that: (1) students exhibited a good command of materials (87%), (2) students exhibited a good command of question structure (88%), and (3) students exhibited a good command of Indonesian-language grammar (88%). This study challenges the assumption that teacher-based learning is ineffective, providing evidence that should be considered when evaluating the learning process and its current emphasis on student-centered learning models that sideline teachers. Direct learning based on giving assignments can increase student success in compiling HOTS questions and be a solution to the learning process, which has so far focused a lot on the student-centered learning model, so that the teacher's position is neglected. It suggests that effective pedagogy should not only consider students as active learners but also recognize teachers as creative and pro-active educators. The implications of this study highlight the need for active collaboration between teachers and students in the learning process in higher education.

Contribution/ Originality: The study fills the gap with previous studies that tend to look at the perspectives of students and teachers separately in the learning process, while this study emphasizes the importance of collaboration between teachers and students in direct task-based instruction that can improve students' ability to prepare HOTS questions.

1. INTRODUCTION

Preparing questions that test students' higher-order thinking skills (HOTS) is a necessary competency for every teacher. University students, as potential teachers, must thus develop the ability to prepare such questions even as they hone their own ability to think critically, creatively, communicatively, and collaboratively. Unfortunately, one survey found that 60% of potential educators are unable to adequately design HOTS questions

[1]. This should greatly concern universities, which must develop a learning model that better prepares future teachers for developing questions that test students' higher-order thinking skills.

Researchers from diverse academic backgrounds have frequently undertaken studies of HOTS. Most studies, however, have focused on three areas. First, the importance of HOTS for improving students' competencies [2-4]. Second, the implementation of HOTS in education institutions, from the primary to the tertiary levels [5, 6] as a means of cultivating critical thinking skills. Third, the implications of a HOTS-based approach for formal education and curricula [7-9] including for students' ability to overcome the challenges they experience during the learning process [10]. Future teachers' ability to prepare HOTS questions, and the effectiveness of using assignment-based direct instruction to enhance said ability, have received little attention. This study thus offers innovative insight into the best approach for preparing future teachers to design questions that assess students' higher-order thinking skills.

This article seeks to fill the aforementioned gap in the literature by showing how assignment-based direct instruction can improve university students' ability to prepare HOTS questions. In so doing, it assesses future teachers' ability to develop HOTS questions: *first*, based on their command of the materials covered; *second*, based on the formulation or construction of the questions; and *third*, based on the questions' adherence to Indonesian-language grammatical conventions. Based on an analysis of these three aspects, this study will map future teachers' ability to develop HOTS questions.

This article challenges the notion that, despite the recent ineffectiveness of direct instruction due to its dependence on teacher-centered learning, teachers remain indispensable as educators. Teacher-centered learning may prove an effective means of improving students' ability to formulate HOTS questions, so long as several components are considered: teaching goals, teaching materials, and student characteristics. Competencies can also be improved by assigning university students the development of HOTS questions, which increases their recognition of the need for clearly formulated questions and correct grammar. Due to these factors, teachers remain important in the learning process and students' ability to realize the desired competencies.

2. LITERATURE REVIEW

2.1. Direct Instruction

The purpose of direct instruction is to sequentially improve students' knowledge through a structured and productive process [11]. It serves to instill in students fundamental skills necessary for them to easily understand the subject matter [12]. At the university level, direct instruction eases lecturers' efforts to convey materials and use said materials as the basis of the learning process, conveying information bit by bit to pique students' interest and improve their understanding [13]. In other words, through direct instruction, students obtain not only information but also the motivation to become active learners [14]. Direct instruction aims to connect students' personal experiences with the presented materials, facilitating their understanding of crucial concepts [15]. As part of its modeling strategy, direct instruction assumes that individuals can learn by observing the activities and behaviors of others. Direct instruction learning employs two distinct models: the procedural model, which involves discussion of how individuals can undertake endeavors effectively, and the declarative model, which involves the statement and elucidation of facts, concepts, principles, and/or generalizations [16]. Through both models, it seeks to use a deductive approach to influence students' behavior. Fundamental components of direct instruction include; (1) the direct shaping of students' skills; (2) goal-oriented learning processes; (3) structured learning materials; (4) structured learning environments; and (5) teachers as structuring forces [17].

2.2. Student Competence

Student competence, having been a cornerstone of learning innovation in recent decades, is the ultimate goal of modern education [18]. As a concept, student competence encompasses the affective, cognitive, and psychomotor

skills and attitudes that are expected of students in the curriculum [19, 20]. By law, the various levels, forms, and types of education are intended to guide Indonesians in increasing their competence and fulfilling their potential [21]. Teachers and lecturers have important roles in this process, being students' dominant sources of guidance [22]. It is hoped that, by improving students' competence, they can become individuals who maintain balance in their thoughts, words, and deeds.

Evaluation and student competence development work together to provide feedback on areas for potential realization and the effectiveness of the learning process [23]. Aspects of student competence include; (1) students' cognitive knowledge, i.e., thought processes and abilities; (2) students' knowledge; (3) students' ability (skill) to complete the assignments assigned to them [24]; (4) students' observation of desired values such as honesty, empathy, and openness; (5) students' attitudes, which shape their future trajectories; and (6) students' desire to undertake certain activities or behave in certain ways [25]. Ultimately, students must be able to apply these aspects of competence in their everyday lives.

2.3. HOTS

As a concept, higher-order thinking skills (commonly abbreviated as HOTS) are rooted in integrated curricula that understand higher-order thinking as foundational for high-quality human capital [3]. HOTS is defined as the processual ability to, after receiving new information, rearrange and expand upon it to find answers to questions and solutions to problems [26]. In principle, HOTS encompasses knowledge transfer, critical thinking, and problem-solving, all of which enable individuals to improve their mental acuity and hone their thinking processes [27]. Researchers have found that a blend of teaching techniques enhances students' capacity to learn and seek knowledge independently [28].

The application of HOTS challenges lecturers to develop students' high- and low-level cognitive skills [29]. Future teachers require the ability to develop and evaluate HOTS questions to ascertain learners' ability to analyze (Level 4), evaluate (Level 5), and create (Level 6) [30]. Such questions can be developed more effectively by involving diverse stakeholders, from the central to the local level, and entrusting them with their particular duties and authorities [7]. In so doing, a HOTS-based approach to learning can prepare students for higher-order thinking and developing HOTS questions.

3. METHODS

This study uses a quantitative descriptive approach to evaluate the ability of future teachers to develop HOTS-based questions. It does not seek to prove or reject a hypothesis. The study took place at Universitas Islam Negeri Kiai Haji Achmad Siddiq in Jember, East Java. Using purposive sampling, it took as its research subjects and respondents' students of the Islamic Education program at the Faculty of Tarbiyah and Pedagogy, Class A1 (one of four classes), which consisted of forty students. This class was selected because, in the previous semester, the average marks of students were similar; such a situation was not found in the other classes. We taught HOTS question preparation to these students through assignment-based direct instruction. Data for this research were collected from assignments completed by respondents, which consisted of twenty items developed to use HOTS for evaluating hypothetical learners' comprehension. Each item included a question grid and a question card. For data collection, *first*, the researchers examined the items developed by the research subjects and considered three components: command of the learning materials (based on seven indicators), command of question formulation (nine indicators), and command of Indonesian-language grammar (four indicators). Second, each indicator was evaluated to produce a score. Collected data were subsequently categorized based on three components: the ability to evaluate learners' command of the learning materials, formulation, and adherence to Indonesian-language grammatical conventions. Analysis was then conducted using a quantitative descriptive approach. Following Möttus, et al. [31] results were divided into three categories: Good (76%-100%), Adequate (56%-75%), and Lacking (0%-55%). This

enabled the researchers to objectively ascertain the effectiveness of using assignment-based direct instruction to guide students in developing HOTS questions for use in Islamic education.

4. RESULTS

4.1. Success Preparing Items that Reflect the Learning Materials

Respondents were able to prepare HOTS questions that reflected the learning materials after receiving direct instruction. We found that 87% of the items prepared by students, along with the question grids and cards, accurately reflected the materials under test. Seven points were considered when ascertaining whether the items developed by respondents reflected the learning materials, as indicated in Table 1:

Table 1. Materials being tested.

Serial number	Point	Number (N=40)	%
1.	Questions adhere to indicators	39	98
2.	Questions use interesting and contextual stems	28	69
3.	Questions evaluate the development of logical processes	32	81
4.	Answers are not found within the stems	35	88
5.	Not routine; innovative	35	88
6.	Options are homogenous and logical	34	85
7.	Questions only have one correct answer	40	100
Average		35	87

The seven points in the above table will be discussed below. First, of the 40 respondents, 38 (98%) prepared items, question grids, and question cards that followed the provided indicators. Second, 28 (69%) of the respondents were able to provide contextual stems that could potentially interest students. Third, 32 (81%) of the 40 respondents used items that required higher-order thinking—i.e., per Bloom, analysis, evaluation, and creation. *Fourth*, 35 (88%) of the 40 respondents did not provide the answers within the stems offered to learners. *Fifth*, 35 (88%) of the respondents prepared innovative items and avoided repetition. *Fourth*, 34 (85%) respondents offered logical, homogenous options (i.e., options of the same form). *Seventh*, 40 (100%) respondents prepared items that had only one correct answer. Overall, respondents were deemed to have prepared items that reflected the materials being tested.

4.2. Success Preparing Items that are Properly Formulated

Respondents' ability to prepare HOTS questions after receiving direct instruction was also analyzed in terms of item formulation. A review of the items, question grids, and question sheets prepared by the respondents indicated that they were able to formulate questions well (88%). Nine points were considered when ascertaining whether the items developed by respondents were properly formulated, as indicated in Table 2:

Table 2. Construction of questions.

Serial number	Point	Number (N=40)	%
1.	Questions are clear and succinct	34	85
2.	Questions and answers only include necessary statements	37	93
3.	Questions do not suggest an answer	37	93
4.	Questions are free of double negatives	38	98
5.	Illustrations, graphs, tables, and diagrams are clear and functional	36	85
6.	Answers are of similar length	38	95
7.	Answers do not include statements such as "all of the above" or "none of the above"	40	100
8.	Answers in the form of numbers/Times are organized from smallest to largest	40	100
9.	Questions do not depend on previous questions for answers	39	98
Average		38	88

We will discuss each of the nine points in the above table. *First*, of the forty respondents, 34 (85%) prepared items that were clear and succinct. *Second*, 37 (93%) of 40 respondents used items and potential answers that only included necessary information. *Third*, 37 (93%) of 40 respondents prepared items that did not suggest an answer. *Fourth*, 38 (98%) of 40 respondents avoided using double negatives in their items. *Fifth*, 36 (85%) of 40 respondents included clear and functional illustrations, graphs, tables, and diagrams with their items when necessary. *Sixth*, 38 (95%) of 40 respondents provided answers that were approximately equal in length. *Seventh*, all 40 of the respondents avoided using phrases such as ‘all of the above’ and ‘none of the above’ in their items. *Eighth*, all 40 (100%) of the respondents arranged answers that consisted of numbers or times from the smallest to the largest. *Ninth*, 39 (98%) of the respondents prepared items that did not depend on previous questions for answers. Overall, the respondents formulated their items properly.

4.3. Success Preparing Items that Adhere to Grammatical Conventions

Respondents were able to prepare HOTS questions that adhered to the grammatical conventions of the Indonesian language. We found 88% of the items prepared by students, along with the questioning grids and cards, to be grammatically correct. Four points were considered when ascertaining whether the items developed by respondents were grammatical, as indicated in [Table 3](#):

Table 3. Grammaticality of questions.

Serial number	Point	Number (N=40)	%
1.	Follows grammatical conventions	32	80
2.	Does not use local language	40	100
3.	Uses communicative sentences	32	80
4.	Answers do not repeat terms	37	92
Average		35	88

The discussion below will focus on the four points in the above table. *First*, 32 (80%) of respondents developed items that followed grammatical conventions. *Second*, all 40 (100%) respondents avoided using local-language terms in their items. *Third*, 32 (80%) of respondents prepared items using effective and communicative sentences. *Fourth*, 37 (92%) of respondents avoided using the same terms in their items and possible answers. Overall, we deemed the items prepared by the respondents to be grammatically correct.

5. DISCUSSION

5.1. Success Preparing Items that Reflect the Learning Materials

Based on the above discussion, respondents were able to prepare HOTS questions that reflected the learning materials. Teachers are better able to prepare test items when they themselves have a command of the materials being tested [32]. Teachers who do not comprehend the learning materials will be unable to prepare high-quality items, and as a result, they will have difficulty ascertaining students' understanding [33]. When future teachers receive knowledge through assignment-based direct instruction, they are better equipped to evaluate the results of the learning process [34]. Direct learning aims to cultivate and refine the procedural skills and factual knowledge essential for learning.

During the learning process, teachers must consider three factors: the goals of learning, the processes of learning, and the evaluation of learning results. Therefore, teachers need to pinpoint the objectives they aim to accomplish during the learning process, and meticulous assessment is necessary to confirm their attainment [35].

The assignment of learning materials is a core competency for any teacher, as it influences students' ability to understand materials; in this case, assignments shaped respondents' ability to develop HOTS questions. As these respondents were also future teachers, they also required the ability to develop lesson plans, test items, and other

instruments for the classroom [36]. As noted by Nofiana [37] one point that must be considered when developing items is teachers' own command of the materials. Likewise, as argued by Permanasari and Purtadi [38] teaching and evaluation are inexorably intertwined [39]. As such, any potential teacher must not only have a command of the learning materials but also develop lesson plans and test instruments [40]. As such, respondents' ability to develop test items was influenced by the model employed in the classroom: assignment-based direct instruction that emphasized the learning process and its evaluation.

5.2. Success Preparing Items that are Properly Formulated

This research indicated that, after receiving direct instruction, respondents were able to develop HOTS questions that were properly formulated and structured. The above-identified nine indicators provided fundamental guidelines to ensure correct item formulation and optimal assessment of the learning process results. Such quality considerations ensured the validity of the items [41].

Guidelines for developing HOTS questions recommend using stems that refer to real-life situations. Multiple-choice questions should consist of the question itself (the stem) and several potential answers (options)—one correct answer and several incorrect answers (distractors) that may be plausibly chosen by students who lack a command of the learning materials. The materials provided to the students beforehand should contain the answers, rather than making them explicit in the stems. Following these guidelines will ensure that items can adequately evaluate students' logical processes and understanding of the materials; in this manner, the results of the learning process can be known [42, 43].

As such, respondents developed the ability to prepare and formulate HOTS questions. The use of assignment-based direct instruction may be responsible for this.

5.3. Success Preparing Items that Adhere to Grammatical Conventions

The data indicate that respondents were able to develop items that complied with the grammatical conventions of the Indonesian language after receiving assignment-based direct instruction. When teachers do not understand the grammatical conventions of their language, they cannot prepare the high-quality test items necessary to objectively evaluate students' understanding [44]. In addition to the structural considerations mentioned earlier, grammar plays a crucial role in the creation of test items, given the close connection between language and the cognitive process of the human mind [9, 45]. Test items should use clear language, offer a clear and logical link between stem and options, minimize confusion, employ age-appropriate language, and comply with the formal rules of the language in which they are written—in the case of Indonesian, the Enhanced Spelling (Ejaan yang Disempurnakan, or EYD) guidelines issued by the Language Bureau [46]. Consequently, teachers must have a good command of formal language and be able to apply it when developing test items. In linguistically diverse countries such as Indonesia, where hundreds of local languages are spoken, formal usage of the national language ensures that students of all backgrounds can understand the test items; indeed, it is for this very reason that the Indonesian government has strived to formalize and standardize the spelling system, vocabulary, and grammar of the Indonesian language [47]. Formal Indonesian, which is most correct in the context of classroom learning in Indonesia, is that which follows official guidelines and can be easily understood by test takers.

Unfortunately, teachers often disregard grammatical conventions when creating test items. As noted by Muyassaroh [48] because teachers often fail to use correct and formal Indonesian when preparing tests, items commonly contain mistakes and omissions. This supports the findings of Gozali, et al. [29]; Rahmawati, et al. [49] and Tahir [50] who show that Indonesian-language tests commonly contain diction, spelling, syntax, and punctuation errors. Ideally, language should be communicative to ensure that its messages are conveyed and understood readily. Where grammatical conventions are not followed, receivers (in this case, test takers) may

misunderstand the intended message and be unable to respond correctly. Therefore, it is crucial to adhere to grammatical conventions.

Respondents were better able to develop HOTS questions that complied with grammatical conventions. This may be attributed to the implementation of assignment-based direct instruction as well as the researchers' provision of grammatical guidance during the item formulation process. With respondents' success in developing HOTS questions after receiving assignment-based direct instruction, several points should be considered. First, when choosing a learning model, it is necessary to consider the type of material and student competencies necessary for learning goals to be achieved effectively and efficiently. Although direct instruction has commonly been branded ineffective, as it is assumed to reduce students to passive learners, this research has shown that, when combined with structured assignments and teacher guidance, direct instruction can facilitate the achievement of learning goals. Second, three variables should be carefully considered when preparing learning activities (1) condition, (2) method, and (3) learning results [51-53]. The condition variable consists of the purpose and characteristics of the learning materials and the challenges and characteristics of the students; the method variable consists of the strategies used for organizing, implementing, and administering the learning processes; and the learning results consist of the effectiveness, efficiency, and appeal of the process. In other words, the success of the learning process is not only influenced by the methods employed, but also by the conditions under which it occurs—including variables that cannot be influenced by educators when designing their lessons.

6. CONCLUSION

The assumption that teacher-centered models of learning do not contribute to students' understanding is not correct. This study has shown that learning goals can be achieved not only through *student-centered learning* but also through models wherein teachers orchestrate lessons, motivate students, and ensure learners' active inclusion. In the case discussed here, respondents were able to develop items that tested students' HOTS while also focusing on the materials covered, using an appropriate structure, and following grammatical conventions. These respondents' success as university students was driven not only by their own active involvement but also by the use of an assignment-based direct instruction model.

This study has contributed a new perspective to the literature, highlighting the potential benefits of teacher-centered learning at a time when studies tend to emphasize the student-centered approach. Its points may thus be considered when evaluating the learning process, which has tended to emphasize student-centered learning while neglecting the important role of teachers. It highlights the need for a combined approach wherein teachers are actively and creatively involved in the process, even as students are given prominence.

The limitations of this study lie in its relatively small sample size, covering only one class in one institution. Therefore, it is necessary to conduct further research using a larger sample size, taking into account the large number of diverse tertiary institutions of education found in Indonesia. Likewise, this study has limited itself to evaluating respondents' ability to develop HOTS questions; it has yet to examine the obstacles experienced by respondents during the process. As such, the development of comprehensive solutions to ongoing issues in education requires a comparative study.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

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