**Table 1 – Framework of item flaws and their potential effect**

|  |  |
| --- | --- |
| Technical item flaws or unadvisable formats  | Potential effect |
| Outmoded item formats |
| True/False Format | **True-false questions require that examinees decide if a statement is true or false – at times a difficult decision, in a world where absolutes are rare. In addition, the examinee may also have to make a value judgment as to what *extent or degree* an option is correct; this may be straightforward, or may involve also trying to anticipate what the examiner had in mind when phrasing the question. (Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Overly complex, or K-type, questions; e.g. choose option A if statements 1 and 2 are correct, choose option B if statements 1 and 3 are correct etc. | **This format introduces unnecessary complexity to the format, increasing reading time, *construct irrelevant variance*, and reducing validity. (Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Downing,**[**2002a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR19)**,**[**2002b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR20)**, Jozefowicz et al.,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR27)**, Haladyna et al.,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR25)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Fill in the blank | **These questions may be linguistically difficult to write, without giving grammatical clues to the examinee, and so are best avoided. (Downing,**[**2002a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR19)**,**[**2002b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR20)**)** |
| Question ambiguity or obscurity |
| Gratuitous information in stem | **Inclusion of irrelevant information introduces unnecessary complexity to the format, increasing reading time, *construct irrelevant variance*, and reducing validity. Stems should be focussed, and only information relevant to answering the question should be included. (Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Downing,**[**2002a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR19)**,**[**2002b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR20)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Ambiguous or unclear information | **Poorly worded questions can confuse examinees, even those of high ability, and are particularly problematic for non-native speakers. (Downing,**[**2002a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR19)**,**[**2002b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR20)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Unfocussed stem | **Questions should be clear and explicit, with a definitive question (Haladyna et al.,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR25)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Absolute terms | **Elimination of options containing the words “always” and “never” greatly improves examinees’ chances of choosing the correct option by chance. In addition, even supposedly absolute terms such as *“always”* or *“never”*****may be interpreted differently, and means that examinees must make a value judgment as to what the writer means by the term in this context. (Holsgrove & Elzubeir,**[**1998**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR26)**, Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Vague frequency terms | **Frequency terms are interpreted very differently by individuals, and their use means that examinees must make a value judgment as to what the writer means by a given frequency term in an individual question context. (Case,**[**1994**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR9)**, Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Negatively worded stem | **Some writers advocate that negative stems *may* occasionally be used, so long as care is taken to phrase them simply and unambiguously. Others hold that high-quality negative MCQs are difficult to write well, and that their inclusion among otherwise positively-phrased questions may be confusing for examinees. (Haladyna et al.,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR25)**, Jozefowicz et al.,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR27)**, Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Structural or logical flaws |
| Problem is in the options not in the stem | **The problem or question of the MCQ should be in the stem, not within the options. Inclusion of the problems within the options instead reduces the format to a true / false, or even a K-type complex format, with all the problems inherent within (above). (Haladyna et al.,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR25)**, Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Logical cues in stem & correct option | **Logical cues (grammatical or numerical) in the stem and options may enable examinees to guess the correct option without any content knowledge. (Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Word repeats in stem & correct answer | **Similar wording in the stem and options enables examinees to guess the correct option without any content knowledge. (Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Downing,**[**2002a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR19)**,**[**2002b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR20)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Longest option is correct | **Writers often have an inherent bias to take extreme care in making the correct option with exact information and precise grammar, increasing the length; examinees may guess the correct option by assuming that the correct option is also the longest. (Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Downing,**[**2002a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR19)**,**[**2002b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR20)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Implausible distractors | **Elimination of implausible distractors greatly improves examinees’ chances of choosing the correct option by chance. (Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| More than one, or no correct answer | **A move away from the *one-best-answer* approach instead reduces the format to a true / false, or even a K-type complex format, with all the problems inherent within (above). (Haladyna et al.,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR25)**, Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Use of all of the above | **The use of “all of the above” means that students may correctly eliminate this option by identifying at least one other response as being incorrect. (Haladyna et al.,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR25)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Use of none of the above | **The use of “none of the above” means that students may correctly eliminate this option by identifying at least one other response as being correct. (Haladyna et al.,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR25)**, Pachai et al.,**[**2015**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR32)**, Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Option order / position of the correct option | **Listing options in a consistent order on printed examination papers avoids bias on the part of the examiner towards edge aversion, i.e. a reluctance to place the correct option in the first or last positions. In a five option MCQ, this may result in option C being correct more often than would be expected by chance. Online examinations may be programmable to randomise option order, and so avoid this issue. (Case,**[**1994**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR9)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**)** |
| Convergence cues | **Writers often have an inherent bias to write distracters derived from the correct option, altering minor words or components; examinees may guess the correct option by choosing the one in which most option components appear together (Case & Swanson,**[**2002**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR10)**, Tarrant et al.,**[**2006a**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR43)**,**[**2006b**](https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-018-0124-z#CR44)**).** |

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