

**PENGARUH INFORMASI UMPAN BALIK EKSTERNAL KNOWLEDGE  
OF RESULT (KR), KNOWLEDGE OF PERFORMANCE (KP) DAN  
FREKUENSI RELATIF YANG BERBEDA TERHADAP TINGKAT  
PENGUASAAN KETERAMPILAN FOREHAND TENIS**

**DISERTASI**

Diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar  
Doktor Pendidikan Olahraga Program Studi Pendidikan Olahraga S3



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UNIVERSITAS PENDIDIKAN INDONESIA

2019

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Dr. UPI, 2019

Sebuah Disertasi yang diajukan untuk memenuhi salah satu syarat memperoleh  
gelar Doktor Pendidikan (Dr.) pada Fakultas Pendidikan Olahraga

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September 2019

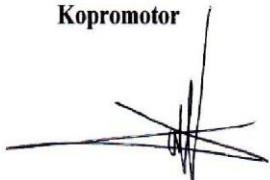
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KETERAMPILAN FOREHAND TENIS

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## ABSTRAK

Umpulan balik eksternal (*augmented feedback*) sudah tidak disangsikan lagi merupakan informasi tambahan penting yang diberikan kepada siswa atau atlet untuk mempercepat proses pembelajaran gerak. Informasi umpan balik yang diberikan dapat berupa informasi tentang hasil gerak (*Knowledge of Result* atau *KR*) dan informasi tentang pola gerak yang ditampilkan (*Knowledge of Performance* atau *KP*). Penelitian ini bertujuan menginvestigasi pengaruh kedua jenis umpan balik eksternal *KP* dan *KR* dengan frekuensi relatif tinggi (100%) dan rendah (33%) terhadap tingkat penguasaan keterampilan forehand groundstroke. Beberapa penelitian yang sudah dilakukan masih memperlihatkan hasil yang belum konsisten. Tugas gerak yang digunakan dalam eksperimen kebanyakan tugas gerak sederhana (*simple skill*) dan dilakukan di dalam kondisi laboratorium, sehingga hasilnya belum tentu bisa diaplikasikan pada pembelajaran keterampilan kompleks (*complex skill*). Begitu pula, penelitian laboratorium yang menggunakan keterampilan kompleks memiliki sifat gerak yang berbeda dengan keterampilan sebenarnya di lapangan. Oleh karena itu, penelitian ini dilakukan dalam usaha untuk memecahkan persoalan yang berkaitan dengan jenis umpan balik dan frekuensi relatif yang tepat digunakan untuk pembelajaran tugas gerak kompleks terutama bagi para pemula di lapangan yang sebenarnya. Pemecahan masalah ini dilakukan dengan metode eksperimen  $2 \times 2$  factorial design, yaitu mencari efek interaksi antara variabel bebas (faktor) umpan balik dengan frekuensi relatifnya terhadap tingkat penguasaan keterampilan forehand tenis. Subjek penelitian adalah mahasiswa prodi PKO peserta perkuliahan tenis praktek yang belum pernah bermain tenis (pemula). Analisis data menggunakan faktorial two-way ANOVA  $2 \times 2$ , tes performa dilakukan pada fase penguasaan untuk menemukan efek performa (*performance effect*), dan tes retensi untuk menemukan efek pembelajaran (*learning effect*). Temuan penelitian menunjukkan terdapat perbedaan pengaruh yang signifikan antara umpan balik eksternal dan frekuensi relatif, serta terjadi interaksi yang signifikan antara umpan balik dengan frekuensi relatif, dimana umpan balik *KR* dan frekuensi relatif 33% menghasilkan skor performa tertinggi, dan umpan balik *KP* 33% menghasilkan skor kualitas gerak tertinggi selama fase penguasaan dan retensi.

**Kata Kunci:** Knowledge of Result (*KR*), Knowledge of Performance (*KP*),  
Frekuensi Relatif

## **ABSTRACT**

External feedback (augmented feedback) is important augmented information given to the students or athletes to increase the process of motor skill learning. Information provided can be in the form of information about the results of movement (Knowledge of Result or KR) and information about the movement pattern (Knowledge of Performance or KP). This field-based study investigated the effect of both types of external feedback KP and KR with a relatively high (100%) and low frequency (33%) on skill acquisition of forehand groundstroke task. The salient role of information feedback as a critical factor that facilitates a performer's skill acquisition has been widely supported in the research literature. However, many studies that have examined motor learning constructs have not utilized actual sports skills, and the majority of this research has been conducted in laboratory setting. As a result of this type of inquiry, the relevance of these research findings to the practitioners in the field has been limited. Beside the tasks used in the experiment are mostly simple tasks (simple skill) and conducted in laboratory conditions, the result could not be generalized to complex skill learning. Further, researches using complex skills has a different nature of movement than actual skills in the field. Therefore, this research was conducted in an effort to solve the problem related to the type of feedback and relative frequencies that are best used for learning complex motor skill for beginners on the actual sports skills. The solution to this problem was solved by the 2 X 2 factorial design, which is to find the interaction effect between the feedback and its relative frequency variables. Novice students enrolled in Pendidikan Kepelatihan Olahraga Department tennis classes ( $N = 40$ ) were randomly assigned to one of four conditions: (a) KP and KR feedback after every trial (100%), (b) KP and KR feedback after every three trial (33%). Data analysis used two-way factorial ANOVA 2 X 2, performance test were done in the acquisition phase to find performance effects, and retention test to find learning effects. The study findings showed (a) significant difference of two external feedback to the overall forehand performance, (b) the effects of the two relative frequency statistically differ from one another, and (c) the interaction between feedback and relative frequency, where KR feedback and 33% relative frequency produced the highest performance score, and KP feedback was 33% the highest movement form score during the acquisition and retention phase.

**Keywords:** Knowledge of Result (KR), Knowledge of Performance (KP),  
Relative Frequency

## DAFTAR ISI

|  | Hal |
|--|-----|
| <b>BAB I PENDAHULUAN</b> .....   | 1   |
| 1.1 Latar Belakang .....   | 1   |
| 1.2 Identifikasi Masalah .....   | 9   |
| 1.3 Rumusan Masalah .....  | 18  |
| 1.4 Tujuan Penelitian .....  | 18  |
| 1.5 Signifikansi Penelitian .....  | 19  |
| 1.6 Pembatasan Penelitian .....  | 19  |
| 1.7 Struktur Organisasi Disertasi .....                                    | 21  |
| <b>BAB II KAJIAN PUSTAKA, KERANGKA PEMIKIRAN HIPOTESIS</b> .....           | 27  |
| A. <b>KAJIAN PUSTAKA</b> .....   | 27  |
| 2.1 Definisi Umpam Balik Eksternal ( <i>Augmented Feedback</i> ) .....     | 27  |
| 2.2 Teori-teori Belajar Gerak dan Umpam Balik Eksternal .....              | 29  |
| 2.3 Fungsi Umpam Balik Eksternal dalam Penguasaan Keterampilan...          | 37  |
| 2.4 Tahapan Pembelajaran Gerak .....                                       | 39  |
| 2.5 Teori-teori tentang Penguasaan Keterampilan .....                      | 42  |
| 2.6 Efek Pembelajaran dengan Instruksi Fokus Atensi Internal dan Eksternal | 44  |
| 2.7 Fokus pada Efek Gerakan atau Tidak Fokus pada Gerakan .....            | 47  |
| 2.8 Pengaruh Jarak dari Efek Eksternal .....                               | 48  |
| 2.9 Umpam Balik KR .....   | 49  |
| 2.9.1 Definisi KR dan Umpam Balik .....                                    | 50  |
| 2.9.2 Reviu Hasil Penelitian tentang KR dalam Pembelajaran Gerak           | 51  |
| 2.9.3 Definisi Pembelajaran ( <i>Learning</i> ) .....                      | 52  |
| 2.9.4 Efek Performa dari KR .....  | 54  |
| 2.9.5 Desain Transfer .....  | 55  |
| 2.9.6 Permasalahan Kriteria .....  | 56  |
| 2.9.7 Permasalahan Variabel Terikat .....                                  | 58  |
| 2.10 Prinsip-prinsip KR .....  | 59  |
| 2.11 Prinsip Kerja KR .....  | 61  |
| 2.12 Frekuensi Relatif dan Absolut KR .....                                | 66  |
| 2.12.1 Isu Teoretis .....  | 67  |
| 2.12.2 Frekuensi Relatif KR .....  | 68  |
| 2.12.3 Ketepatan Informasi KR .....  | 70  |
| 2.13 Umpam Balik KP .....  | 73  |
| 2.13.1 Reviu Penelitian KP dalam Pembelajaran Gerak .....                  | 74  |
| 2.13.2 Frekuensi Relatif KP .....  | 76  |
| 2.14 Reviu Pembelajaran ( <i>Learning</i> ) vs Performa .....              | 84  |
| 2.15 Hasil-hasil Penelitian tentang Pembelajaran .....                     | 85  |

|  |            |
|--|------------|
| 2.15.1 Pembelajaran Laten .....                                      | 86         |
| 2.15.2 Overlearning dan Kelelahan .....                              | 87         |
| 2.15.3 Variabilitas Latihan .....                                    | 88         |
| 2.16 Frekuensi Relatif Tinggi dan Pembelajaran Keterampilan Kompleks | 90         |
| 2.17 Kualifikasi Efek Frekuensi Relatif Umpan Balik .....            | 92         |
| 2.18 Kesimpulan .....  | 94         |
| <b>B. KERANGKA PEMIKIRAN .....</b>                                   | <b>95</b>  |
| <b>C. HIPOTESIS .....</b>  | <b>109</b> |
| <b>BAB III METODE PENELITIAN .....</b>                               | <b>110</b> |
| 3.1 Desain Penelitian .....  | 110        |
| 3.2 Partisipan .....   | 112        |
| 3.3 Populasi dan Sampel .....  | 113        |
| 3.4 Instrumen Penelitian .....                                       | 113        |
| 3.5 Prosedur Penelitian .....  | 115        |
| 3.5.1 Operasionalisasi Desain .....                                  | 115        |
| 3.5.2 Identifikasi dan Definisi Operasional Variabel .....           | 121        |
| 3.6 Alur Penelitian .....  | 124        |
| 3.7 Hipotesis Penelitian (secara Statistik) .....                    | 125        |
| 3.8 Analisis Data .....  | 129        |
| <b>BAB IV TEMUAN DAN PEMBAHASAN .....</b>                            | <b>132</b> |
| <b>A. TEMUAN .....</b>   | <b>132</b> |
| 4.1 Analisis Data Tes Penguasaan .....                               | 133        |
| 4.1.1 Uji Normalitas .....   | 133        |
| 4.1.2 Uji Homogenitas .....  | 140        |
| 4.1.3 Uji Main Effects .....   | 142        |
| 4.1.4 Uji Interaksi .....  | 148        |
| 4.1.5 Uji Simple Main Effects .....                                  | 150        |
| 4.1.6 Analisis Kualitas Gerak .....                                  | 151        |
| 4.2 Analisis Data Tes Retensi .....                                  | 151        |
| 4.2.1 Uji Normalitas .....   | 152        |
| 4.2.2 Uji Homogenitas .....  | 158        |
| 4.2.3 Uji Main Effects .....   | 161        |
| 4.2.4 Uji Interaksi .....  | 162        |
| 4.2.5 Uji Simple Main Effects .....                                  | 171        |
| 4.2.6 Analisis Kualitas Gerak .....                                  | 172        |
| <b>B. PEMBAHASAN .....</b>   | <b>175</b> |
| <b>BAB V KESIMPULAN, IMPLIKASI, DAN REKOMENDASI .....</b>            | <b>221</b> |

|   |     |
|---|-----|
| <b>DAFTAR PUSTAKA .....</b>                                 | 227 |
| <b>DAFTAR TABEL .....</b>                                   | 228 |
| Tabel 2.1 Efek KR terhadap Performa dan Pembelajaran.....   | 75  |
| Tabel 3.1 Kombinasi Treatment 2 X 2 .....                   | 111 |
| Tabel 3.2 Kriteria Penilaian Kualitas Gerak Forehand .....  | 115 |
| \ Tabel 3.4 Daftar Pernyataan Umpan Balik KP .....          | 119 |
| Tabel 3.5 Daftar Pernyataan Umpan Balik KR .....            | 120 |
| Tabel 3.6 Alur Penelitian .....                             | 125 |
| Tabel 4.1 Uji Normalitas Kelompok Umpan Balik KP 33% .....  | 134 |
| Tabel 4.2 Uji Normalitas Kelompok Umpan Balik KP 100% ..... | 135 |
| Tabel 4.3 Uji Normalitas Kelompok Umpan Balik KR 33% .....  | 137 |
| Tabel 4.4 Uji Normalitas Kelompok Umpan Balik KR 100% ..... | 138 |
| Tabel 4.5 Statistika Deskriptif .....                       | 140 |
| Tabel 4.6 Uji Homogenitas Levene Test .....                 | 141 |
| Tabel 4.7 Uji ANOVA Dua Jalur .....                         | 142 |
| Tabel 4.8 Main Effects Umpan Balik .....                    | 143 |
| Tabel 4.9 Main Effects Frekuensi Relatif .....              | 146 |
| Tabel 4.10 Efek Interaksi .....                             | 147 |
| Tabel 4.12 Simple Main Effects .....                        | 149 |
| Tabel 4.13 Uji Signifikansi Simple Main Effects .....       | 150 |
| Tabel 4.1 Uji Normalitas Kelompok Umpan Balik KP 33% .....  | 152 |
| Tabel 4.2 Uji Normalitas Kelompok Umpan Balik KP 100% ..... | 154 |
| Tabel 4.3 Uji Normalitas Kelompok Umpan Balik KR 33% .....  | 155 |
| Tabel 4.4 Uji Normalitas Kelompok Umpan Balik KR 100% ..... | 157 |
| Tabel 4.5 Statistika Deskriptif .....                       | 159 |
| Tabel 4.6 Uji Homogenitas Levene Test .....                 | 161 |
| Tabel 4.7 Uji ANOVA Dua Jalur .....                         | 162 |
| Tabel 4.8 Main Effects Umpan Balik .....                    | 163 |
| Tabel 4.9 Main Effects Frekuensi Relatif .....              | 164 |
| Tabel 4.10 Efek Interaksi .....                             | 165 |
| Tabel 4.12 Simple Main Effects .....                        | 167 |
| Tabel 4.13 Uji Signifikansi Simple Main Effects .....       | 168 |
| <b>DAFTAR GAMBAR .....</b>                                  | 229 |
| Gambar 2.1 Tahapan Model Pembelajaran Fitts & Posner .....  | 40  |
| Gambar 2.2 Kurva Hipotesis Performa .....                   | 105 |
| Gambar 2.3 Kerangka Pemikiran .....                         | 108 |
| Gambar 4.2 QQ Plot Distribusi Normal KP 33%.....            | 135 |
| Gambar 4.3 QQ Plot Distribusi Normal KP 100%.....           | 136 |
| Gambar 4.4 QQ Plot Distribusi Normal KR 33%.....            | 138 |
| Gambar 4.5 QQ Plot Distribusi Normal KR 100%.....           | 139 |
| Gambar 4.6 Nilai Rata-Rata Marjinal Akurasi Forehand .....  | 148 |

|   |     |
|---|-----|
| <b>DAFTAR LAMPIRAN .....</b>                                | 230 |
| Lampiran 1 Program Eksperimen dan Pengumpulan Data .....    | 231 |
| Lampiran 2 Data Hasil Pengukuran Tes Akurasi Forehand ..... | 235 |
| Lampiran 3 Data Hasil Validasi Instrumen .....              | 237 |

## DAFTAR PUSTAKA

- A Schmidth, R., & D.Lee, T. (2014). *Motor Learning and Performance Fifth Edition*.
- Adams, J. a. (1987). Historical review and appraisal of research on the learning, retention, and transfer of human motor skills. *Psychological Bulletin, 101*(1), 41–74.  
<https://doi.org/10.1037/0033-2909.101.1.41>
- Adams, J. A. (1971). A closed-loop theory of motor learning. *Journal of Motor Behavior, 3*(2), 111–150. <https://doi.org/10.1080/00222895.1971.10734898>
- Adams, J. A. (1990). *University of Illinois at Urbana-Champaign, USA*. 9(317), 209–220.
- Adams, J. A., & Adams, J. A. (2013). *A CLOSED-LOOP THEORY OF MOTOR LEARNING , 2 Department of Psychology University of Illinois from the literature are stated , and the theory is used to explain them . of knowledge of results , and the effects of withdrawing knowledge of Background of Skills*. (September 2014), 37–41.  
<https://doi.org/10.1080/00222895.1971.10734898>
- Amorose, A. J., & Smith, P. J. K. (2016). Feedback as a Source of Physical Competence Information: Effects of Age, Experience and Type of Feedback. *Journal of Sport and Exercise Psychology, 25*(3), 341–359. <https://doi.org/10.1123/jsep.25.3.341>
- Anderson, D. I., Magill, R. A., & Sekiya, H. (2001). Motor learning as a function of KR schedule and characteristics of task-intrinsic feedback. *Journal of Motor Behavior, 33*(1), 59–66. <https://doi.org/10.1080/00222890109601903>
- Bilodeau. (1959). *More Effect of Introducing and Withdrawing Knowledge of Results Early and Lat in Practice*.
- Blackwell, J. R., & Newell, K. M. (1996). The informational role of knowledge of results in motor learning. *Acta Psychologica, 92*(2), 119–129. [https://doi.org/10.1016/0001-6918\(95\)00013-5](https://doi.org/10.1016/0001-6918(95)00013-5)
- Buekers, M. J. A., Magill, R. A., & Hall, G. (2014). *The Quarterly Journal of Experimental Psychology Section A : Human Experimental Psychology The Effect of Erroneous Knowledge of Results on Skill Acquisition when Augmented Information is Redundant*. (December). <https://doi.org/10.1080/14640749208401285>
- Buekers, M. J., & Magill, R. A. (1995). The Role of Task Experience and Prior Knowledge for Detecting Invalid Augmented Feedback while Learning a Motor Skill. *The Quarterly*

- Journal of Experimental Psychology Section A*, 48(1), 84–97.  
<https://doi.org/10.1080/14640749508401377>
- Capiro, C. M., Sit, C. H. P., Abernethy, B., & Masters, R. S. W. (2012). The possible benefits of reduced errors in the motor skills acquisition of children. *Sports Medicine, Arthroscopy, Rehabilitation, Therapy and Technology*, 4(1), 2–5.  
<https://doi.org/10.1186/1758-2555-4-1>
- Cooper, L. K., & Rothstein, A. L. (n.d.). *Research Quarterly for Exercise and Sport Videotape Replay and the Learning of Skills in Open and Closed Environments*. (February 2015), 37–41. <https://doi.org/10.1080/02701367.1981.10607857>
- Emmen, H. H., Wesseling, L. G., Bootsma, R. J., & Whiting, H. T. A. (n.d.). *The effect of video - modelling and video - feedback on the learning of the tennis service by novices*. *The effect of video-modelling and video-feedback on the learning of the tennis service by novices*. (February 2015), 37–41. <https://doi.org/10.1080/02640418508729742>
- Gentile, A. M. (1972). A working model of skill acquisition with application to teaching. *Quest*, 17(1), 3–23. <https://doi.org/10.1080/00336297.1972.10519717>
- Guadagnoli, M. A., Lee, T. D., Guadagnoli, M. A., & Lee, T. D. (2010). *Challenge Point : A Framework for Conceptualizing the Effects of Various Practice Conditions in Motor Learning*. (August 2014), 37–41. <https://doi.org/10.3200/JMBR.36.2.212-224>
- Hebert, E. P., Landin, D., & Hebert, E. P. (2013). *on Tennis Skill Acquisition on Tennis Skill Acquisition*. (December 2014), 37–41. <https://doi.org/10.1080/02701367.1994.10607626>
- Hodges, N. J., & Franks, I. M. (2013). *Learning a Coordination Skill : Interactive Effects of Instruction and Feedback*. (October 2014), 37–41.  
<https://doi.org/10.1080/02701367.2001.10608943>
- Hogan, J. C., & Yanowitz, B. A. (1978). The role of verbal estimates of movement error in ballistic skill acquisition. *Journal of Motor Behavior*, 10(2), 133–138.  
<https://doi.org/10.1080/00222895.1978.10735146>
- Holding, C. S., & Holding, D. H. (1989). Acquisition of route network knowledge by males and females. *Journal of General Psychology*, 116(1), 29–41.  
<https://doi.org/10.1080/00221309.1989.9711108>
- Hw, L., & Shea, J. B. (1978). *Results O N Retention of a Motor Skill*. 859–866.
- Kernodle, M. W., & Carlton, L. G. (1992). Information feedback and the learning of multiple-

- degree-of-freedom activities. *Journal of Motor Behavior*, 24(2), 187–195.  
<https://doi.org/10.1080/00222895.1992.9941614>
- Kernodle, M. W., Carlton, L. G., Kernodle, M. W., & Carlton, L. G. (2015). *Information Feedback and the Learning of Multiple-Degrees-of-freedom Activities*. 2895(September). <https://doi.org/10.1080/00222895.1992.9941614>
- Kerr, R., & Booth, B. (1978). Specific and varied practice of motor skill. *Perceptual and Motor Skills*, 46(2), 395–401. <https://doi.org/10.1177/003151257804600201>
- Lai, Q., & Shea, C. H. (1998). Generalized motor program (GMP) learning: Effects of reduced frequency of knowledge of results and practice variability. *Journal of Motor Behavior*, 30(1), 51–59. <https://doi.org/10.1080/00222899809601322>
- Landin, D. K., Hebert, E. P., & Fairweather, M. (1993). The effects of variable practice on the performance of a basketball skill. / Effets d'une pratique variable sur la performance d'un exercice de basket-ball. *Research Quarterly for Exercise & Sport*, 64(2), 232–237.
- Retrieved from  
<http://articles.sirc.ca/search.cfm?id=320100%5Cnhttp://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=SPH320100&lang=pt-br&site=ehost-live%5Cnhttp://www.aahperd.org/>
- Lee, A. M., Keh, N. C., & Magill, R. A. (2016). Instructional Effects of Teacher Feedback in Physical Education. *Journal of Teaching in Physical Education*, 12(3), 228–243.  
<https://doi.org/10.1123/jtpe.12.3.228>
- Lee, T. D., & Carnahan, H. (1990). Bandwidth knowledge of results and motor learning: More than just a relative frequency effect. *The Quarterly Journal of Experimental Psychology Section A*, 42(4), 777–789. <https://doi.org/10.1080/14640749008401249>
- Magill, R. A. (1994). The influence of augmented feedback on skill learning depends on characteristics of the skill and the learner. *Quest*, 46(3), 314–327.  
<https://doi.org/10.1080/00336297.1994.10484129>
- Magill, R. A. (2012). *The Influence of Augmented Feedback on Skill Learning Depends on Characteristics of the Skill and the Learner*. (May 2015), 314–327.  
<https://doi.org/10.1080/00336297.1994.10484129>
- Magill, R. A., Chamberlin, C. J., & Hall, K. G. (1991). Verbal knowledge of results as redundant information for learning an anticipation timing skill. *Human Movement*

- Science*, 10(4), 485–507. [https://doi.org/10.1016/0167-9457\(91\)90016-Q](https://doi.org/10.1016/0167-9457(91)90016-Q)
- Magill, & Richard A. (1993). *Modeling and verbal feedback influences on skill learning*.
- Maxwell, J. P., Masters, R. S. W., & Eves, F. F. (2003). The role of working memory in motor learning and performance. *Consciousness and Cognition*, 12(3), 376–402.  
[https://doi.org/10.1016/S1053-8100\(03\)00005-9](https://doi.org/10.1016/S1053-8100(03)00005-9)
- McDonald, P. V., Van Emmerik, R. E. A., & Newell, K. M. (1989). The effects of practice on limb kinematics in a throwing task. *Journal of Motor Behavior*, 21(3), 245–264.  
<https://doi.org/10.1080/00222895.1989.10735480>
- Newell, K. M. (1974). *Knowledge of results and motor learning*.
- Newell, K. M., & Kennedy, J. A. (1978). Knowledge of results and children's motor learning. *Developmental Psychology*, 14(5), 531–536. <https://doi.org/10.1037/0012-1649.14.5.531>
- Newell, K. M., Quinn, J. T., Sparrow, W. A., & Walter, C. B. (1983). Kinematic information feedback for learning a rapid arm movement. *Human Movement Science*, 2(4), 255–269.  
[https://doi.org/10.1016/0167-9457\(83\)90021-0](https://doi.org/10.1016/0167-9457(83)90021-0)
- Oxendine, J. B. (1970). Emotional arousal and motor performance. *Quest*, 13(1), 23–32.  
<https://doi.org/10.1080/00336297.1970.10519673>
- Salmon, A. W., Schmidt, R. A., & Walter, C. B. (1984). *Knowledge of Results and Motor Learning : A Review and Critical Reappraisal*. 95(3), 355–386.
- Salmoni, A. W. (n.d.). *Research Quarterly for Exercise and Sport The Effect of Precision of Knowledge of Results on the Performance of a Simple Line Drawing Task for Children and Adults*. (October 2014), 37–41. <https://doi.org/10.1080/02701367.1980.10608082>
- Schmidt, R. A. (1975a). A schema theory of discrete motor skill learning. *Psychological Review*, 82(4), 225–260. <https://doi.org/10.1037/h0076770>
- Schmidt, R. A. (1975b). *PSYCHOLOGICAL REVIEW*. 82(4).
- Schmidt, R. A. (2012). Frequent Augmented Feedback Can Degrade Learning: Evidence and Interpretations. *Tutorials in Motor Neuroscience*, 59–75. [https://doi.org/10.1007/978-94-011-3626-6\\_6](https://doi.org/10.1007/978-94-011-3626-6_6)
- Schmidt, R. A., & Young, D. E. (1991). Methodology for motor learning: A paradigm for kinematic feedback. *Journal of Motor Behavior*, 23(1), 13–24.  
<https://doi.org/10.1080/00222895.1991.9941590>
- Schmidt, R. A., Young, D. E., Schmidt, R. A., & Young, D. E. (2010). *Methodology for*

- Motor Learning : A Paradigm for Kinematic Feedback.* (March 2013), 37–41.
- Shea, C. H., & Wulf, G. (1999). Enhancing motor learning through external-focus instructions and feedback. *Human Movement Science*, 18(4), 553–571.  
[https://doi.org/10.1016/S0167-9457\(99\)00031-7](https://doi.org/10.1016/S0167-9457(99)00031-7)
- Singer, R. N., Lidor, R., & Cauraugh, J. H. (2016). To Be Aware or Not Aware? What to Think about while Learning and Performing a Motor Skill. *The Sport Psychologist*, 7(1), 19–30. <https://doi.org/10.1123/tsp.7.1.19>
- Skills, M., & Gonz, M. Z. (2016). *Learning volleyball serves : A preliminary study of the effects of knowledge of performance and of results.* (August).  
<https://doi.org/10.2466/PMS.89.5.223-232>
- Soderstrom, N. C., & Bjork, R. A. (2015). Learning Versus Performance. *Perspectives on Psychological Science*, 10(2), 176–199. <https://doi.org/10.1177/1745691615569000>
- Sullivan, K. J., Kantak, S. S., & Burtner, P. A. (2008). *Motor Learning in Children : Feedback Effects on Skill Acquisition.* 88(6).
- Sullivan, K. J., Kantak, S. S., & Burtner, P. A. (2008). Motor Learning in Children: Feedback Effects on Skill Acquisition. *Physical Therapy*, 88(6), 720–732.  
<https://doi.org/10.2522/ptj.20070196>
- Swinnen, S. P., Jardin, K., & Meulenbroek, R. (1996). Between-limb asynchronies during bimanual coordination: Effects of manual dominance and attentional cueing. *Neuropsychologia*, 34(12), 1203–1213. [https://doi.org/10.1016/0028-3932\(96\)00047-4](https://doi.org/10.1016/0028-3932(96)00047-4)
- Swinnen, S. P., Schmidt, R. A., Nicholson, D. E., & Shapiro, D. C. (1990). Information Feedback for Skill Acquisition: Instantaneous Knowledge of Results Degrades Learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, Vol. 16, pp. 706–716. <https://doi.org/10.1037/0278-7393.16.4.706>
- Van Wieringen, P. C. W., Emmen, H. H., Bootsma, R. J., Hoogesteger, M., & Whiting, H. T. A. (1989). The effect of video-feedback on the learning of the tennis service by intermediate players. *Journal of Sports Sciences*, 7(2), 153–162.  
<https://doi.org/10.1080/02640418908729833>
- Vereijken, B., Emmerik, R. E. A., Whiting, H. T. A., & Newell, K. M. (1992). Free(z)ing degrees of freedom in skill acquisition. *Journal of Motor Behavior*, 24(1), 133–142.  
<https://doi.org/10.1080/00222895.1992.9941608>

- Vieira, M. M., Ugrinowitsch, H., Gallo, L. G., Carvalho, M. F. S. P., Fonseca, M. A., & Benda, R. N. (2014). Effects of summary knowledge of results in motor skills acquisition. *Revista de Psicología Del Deporte*.
- Vint, P., States, U., & Committee, O. (2000). *Getting Better*. (1994), 127–135.
- Weeks, D. L., & Kordus, R. N. (1998). Relative frequency of knowledge of performance and motor skill learning. *Research Quarterly for Exercise and Sport*, 69(3), 224–230. <https://doi.org/10.1080/02701367.1998.10607689>
- Williams, A. M., Davids, K., Burwitz, L., & Williams, J. G. (1994). Visual search strategies in experienced and inexperienced soccer players. *Research Quarterly for Exercise and Sport*, 65(2), 127–135. <https://doi.org/10.1080/02701367.1994.10607607>
- Winstein\_1990\_JExpPsy.pdf*. (n.d.).
- Winstein-Schmidt1990.pdf*. (n.d.).
- Wishart, L. R., & Lee, T. D. (2011). Effects of Aging and Reduced Relative Frequency of Knowledge of Results on Learning a Motor Skill. *Perceptual and Motor Skills*, 84(3), 1107–1122. <https://doi.org/10.2466/pms.1997.84.3.1107>
- wulf, gabriele, & schmidt, richard. (1993). *Reduced Feedback Frequency Enhances Generalized Motor Program*. Retrieved from [http://www.hps-research.com/sites/default/files/publications/Wulf et al. \(JEPLMC, 1993\).pdf](http://www.hps-research.com/sites/default/files/publications/Wulf et al. (JEPLMC, 1993).pdf)
- Wulf, G., Höß, M., & Prinz, W. (1998). Instructions for motor learning: Differential effects of internal versus external focus of attention. *Journal of Motor Behavior*, 30(2), 169–179. <https://doi.org/10.1080/00222899809601334>
- Wulf, G., & Shea, C. H. (2002a). *Principles derived from the study of simple skills do not generalize to complex skill learning*. 9(2), 185–211.
- Wulf, G., & Shea, C. H. (2002b). Wulf & Shea, 2002 Complex motor. *Psychonomic Bulletin & Review*, 9(2), 185–211. <https://doi.org/10.3758/BF03196276>
- Wulf, G., Shea, C. H., & Matschiner, S. (1998). Frequent feedback enhances complex motor skill learning. *Journal of Motor Behavior*, 30(2), 180–192. <https://doi.org/10.1080/00222899809601335>
- Wulf, G., Shea, C., & Lewthwaite, R. (2010). Motor skill learning and performance: A review of influential factors. *Medical Education*, 44(1), 75–84. <https://doi.org/10.1111/j.1365-2923.2009.03421.x>

Young, D. E., Schmidt, R. A., Young, D. E., & Schmidt, R. A. (2010). *for Motor Learning*. (January 2015), 37–41. <https://doi.org/10.1080/00222895.1992.9941621>